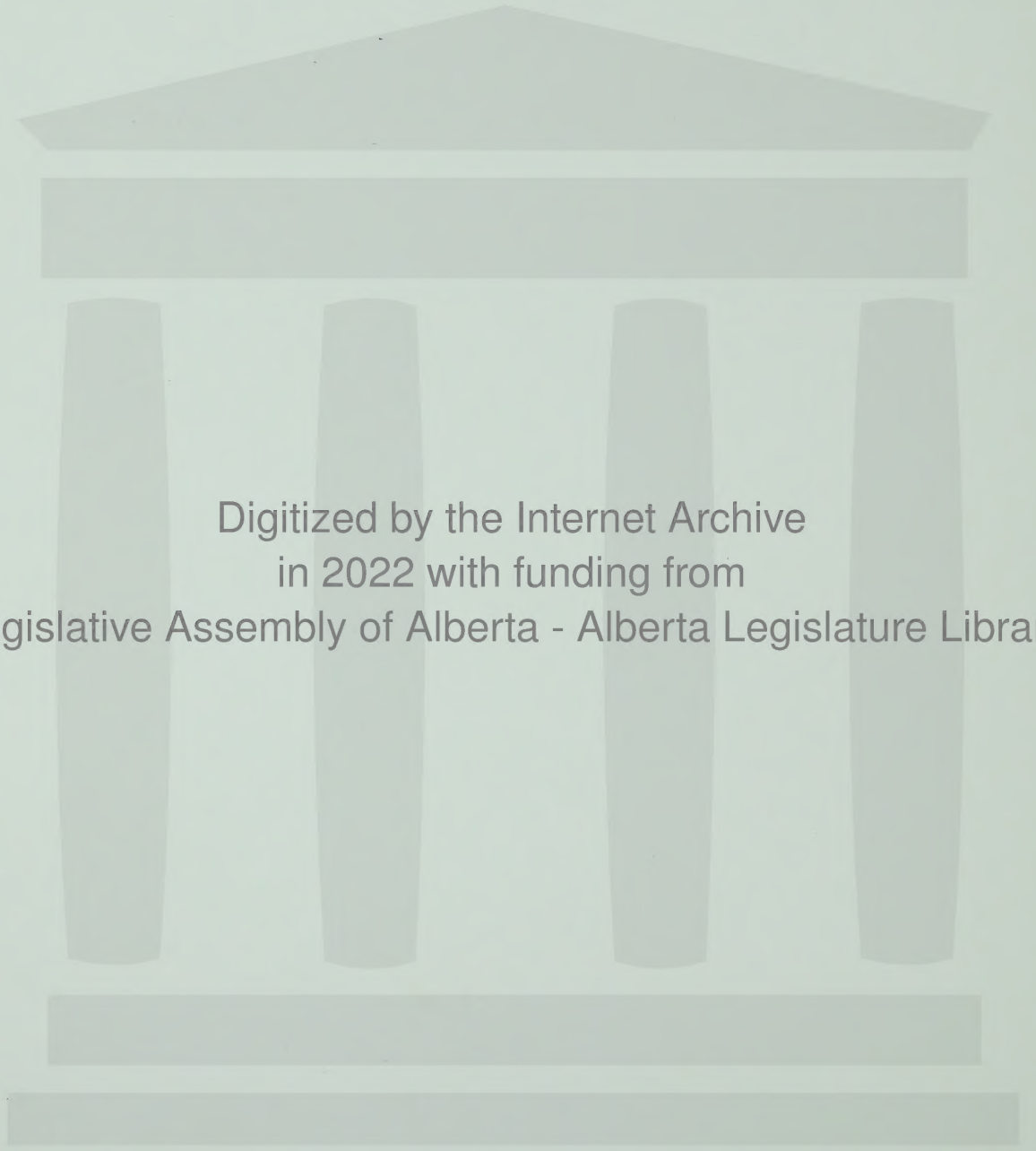
REPORT ON THE APPLICATIONS FOR PERMITS AUTHORIZING THE REMOVAL OF PROPANE FROM THE PROVINCE OF CANADIAN HYDROCARBONS LIMITED AND THE BRITISH AMERICAN OIL COMPANY LIMITED UNDER THE GAS RESOURCES PRESERVATION ACT, 1956

SEPTEMBER 1965

OIL AND GAS CONSERVATION BOARD
603 SIXTH AVENUE SOUTH WEST • CALGARY, ALBERTA



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I INTRODUCTION

This report deals with applications by Canadian Hydrocarbons Limited and The British American Oil Company Limited, each made pursuant to The Gas Resources Preservation Act, 1956, and each requesting a permit authorizing the removal of propane from the Province. The application by Canadian Hydrocarbons Limited (hereinafter called "Canadian Hydrocarbons") was heard by this Board on April 20, 21, 28 and 29, 1965, and the application by The British American Oil Company Limited (hereinafter called "British American") was heard on June 2, 1965.

The Gas Resources Preservation Act, 1956, provides that the Board shall not grant a permit for the removal of propane from the Province unless in its opinion it is in the public interest to do so having regard to the present and future needs of persons within the Province and the established reserves and the trends in growth and discovery of reserves of propane in the Province. Applications for permits for the removal of propane, and other liquid products of gas, were the subject of two earlier reports of the Board. The later of these, (1) issued in August, 1962, resulted in the granting of a permit to Pacific Petroleums Ltd. for the removal from the Province of propane and butanes obtained at its Empress plant from the processing of gas owned by Trans-Canada Pipe Lines

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(1) Report to the Lieutenant Governor in Council with respect to the Application under The Gas Resources Preservation Act, 1956, of Pacific Petroleums Ltd. August, 1962.

Limited. The earlier report, (2) concerning an unsuccessful application and made in June, 1961, was the last in which the supply and demand for propane in Alberta were considered at length.

Because the Board had not completed its study of the Canadian Hydrocarbons application before the British American hearing, it decided to deal with both of the subject applications in this one report.

Canadian Hydrocarbons Application

In its application, Canadian Hydrocarbons asked for a permit authorizing it to remove from the Province propane produced, purchased or otherwise acquired by it in the Harmattan-Elkton Field and other fields in the Province, the total volumes of which would not exceed 15,000,000 barrels. The annual volumes would vary from year to year. The requested term of the permit would be a period of twenty years from October 31, 1966. The propane, supplemented by volumes of condensate and butanes, would be transported through a pipe line to be constructed by Hydrocarbons Pipeline Limited to run from the Harmattan-Elkton Field to Sumas Peak, British Columbia.

An outline of the application, based upon the Canadian Hydrocarbons submission and evidence presented by this applicant, appears in Section III of this report. The various parts of the application are discussed in detail in the appendices.

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(2) Report to the Lieutenant Governor in Council with respect to Application under The Gas Resources Preservation Act, 1956, of Foothills Pipe Lines Ltd. June, 1961.

At the hearing, R. A. MacKimmie, Q.C. and F. T. Phillips appeared for the applicant.

British American Application

The permit for which British American applied would authorize it to remove from Alberta, propane produced, purchased or otherwise acquired by it from the Rimbey, Nevis and Pincher Creek Gas Plants. During the proposed term of ten years from November 15, 1965, British American would remove 730,000 barrels of propane annually and 7,300,000 barrels in total. The propane would be transported from Alberta to Ontario by railway tank car.

An outline of the application, based upon the British American submission and evidence presented by this applicant, appears in Section IV of this report. The various parts of the application are discussed in detail in the appendices.

Appearing for the applicant was W. M. Winterton.

II INTERVENERS

The interveners at the hearing of the Canadian Hydrocarbons application were as follows:

Interveners	Represented by	Abbreviation of name used in Report
Alberta and Southern Gas Co. Ltd. and Alberta Natural Gas Company	G. D. Nichols	
The British American Oil Company Limited	W. M. Winterton	British American
Chemcell (1963) Limited	J. A. Relf	Chemcell
Cigas Products Ltd.	R. A. F. Montgomery and J. C. Crawford	Cigas
Mountain Pacific Pipeline Ltd.	J. B. Ballem	Mountain Pacific

There were no interveners at the British American hearing.

III SUBMISSION OF CANADIAN HYDROCARBONS LIMITED

Application

Canadian Hydrocarbons applied to the Board for a permit authorizing it to remove 15 million barrels of propane from Alberta during a twenty-year period. The applicant proposes to remove an average of some 3,400 barrels per day commencing in 1966 decreasing thereafter to about 1,700 barrels per day until 1977, and continuing at this rate for the remainder of the twenty-year period.

Hydrocarbons Pipeline Limited, a wholly owned subsidiary of Canadian Hydrocarbons, proposes to construct a 6-5/8 inch pipe line capable of transporting 12,000 barrels of liquid hydrocarbons per day from the Harmattan area gas processing plant southward to the Crowsnest Pass and then westward to Sumas Peak, British Columbia, some 20 miles east of Vancouver. In addition to propane, Canadian Hydrocarbons expects to transport through the pipe line some 1,500 barrels per day of butanes and initially, 5,000 barrels per day of pentanes plus, tendered to it by producers in the Harmattan area. The products would be moved in batches. The applicant stated that the volumes of butanes and pentanes plus do not represent new movements out of Alberta, as they are at present being moved by other means. The pipe line would be common carrier facility with respect to all natural gas liquids shipped.

Facilities for the storage of 100,000 barrels of propane and butanes would be constructed underground by Fort St. John Petroleums Ltd. at Sumas Peak. An additional 100,000 barrels of

underground storage is expected to be constructed in the fourth year of operation. Pipe line taps will be provided at Yahk and Oliver, British Columbia, to serve market facilities at these centres. Initially, Canadian Hydrocarbons will procure all of its contracted throughput from the Harmattan-Elkton and the Harmattan East fields. The applicant presented letter agreements relating to the purchase of some 7.6 million barrels of propane from Shell Canada Limited (hereinafter called "Shell") and Canadian Superior Oil Ltd. (hereinafter called "Canadian Superior"). There are in addition to the two major producers, a number of other producers owning propane produced in the plant, which the applicant estimated to total some 5.0 million barrels during the twenty-year period. Although these minority interest volumes have not yet been placed under contract, Canadian Hydrocarbons expects arrangements for the purchase of them will be made through Canadian Superior. The letter agreements filed with the Board provide that each producer may withhold from the above volumes up to 20 per cent for sale in local markets.

Reserves of Propane

Mr. R. R. McDaniel of McDaniel Consultants Ltd., on behalf of the applicant, presented a study of the reserves of propane estimated to exist in Alberta from established reserves of gas, from gas to be discovered during the period 1964 to 1974, and from the reserves of gas expected to be discovered after 1974 in the Province. The estimates were predicated primarily on data prepared and published by the Board.

The recoverable reserves of propane in Alberta based on the

Board's estimate of the established reserves of gas as of December 31, 1963, adjusted for 1964 production, were estimated by Mr. McDaniel employing two different assumptions. Firstly, if propane is recovered through existing facilities or through equivalent facilities to be constructed in fields presently shut-in, the reserves of propane were estimated to total 324 million barrels. Secondly, if "deep-cut facilities" were installed to process all of the established reserves of gas, the recoverable reserves of propane would be some 390 million barrels. Deep-cut facilities are facilities for the extraction from the gas stream of the maximum economic quantity of propane, which in the McDaniel study was assumed to be 85 per cent.

Mr. McDaniel estimated the recoverable reserves of propane from established reserves of gas in three categories. These were:

	Millions of Barrels	
	Existing Conditions	Including Deep-Cut Facilities
Present plants	268	
Known future plants (1)	7	
Sub-Total	275	307
Expected future plants(2)	49	83
Total Reserves	324	390

(1) Plants under construction or planned for construction within about a year in the Crossfield East, Edson, Sylvan Lake and Willesden Green Fields.

(2) Plants expected to be constructed in the future to process the established reserves of gas feeding to pipe line systems other than Trans-Canada Pipe Lines Limited. Also included are plants expected in fields now cycling gas.

Mr. McDaniel estimated that in addition to the propane reco-

verable from established reserves of gas, some 147 million barrels of propane could be recovered at present recovery rates from gas to be discovered during the period 1964 to 1974. In his estimate he used a gas finding rate of 1.8 trillion cubic feet per year for the period 1964 to 1970, decreasing thereafter to 1.5 trillion cubic feet by 1974. Although Mr. McDaniel considered it reasonable that during the years 1964 to 1974 some 19.1 trillion cubic feet of new gas reserves will be developed in Alberta, he suggested that only the propane reserves associated with gas to be discovered during the first two years of the period, estimated to be 28 million barrels at present recovery rates or 48 million if deep-cut facilities were installed, be used when determining the quantity of propane surplus to the Province's thirty-year requirements and the present permit commitment.

Finally, assuming the ultimate recoverable reserves of gas in Alberta to be 80 trillion cubic feet, Mr. McDaniel estimates that a further 169 million barrels of propane could be recovered at present recovery rates, from the reserves of gas to be discovered after 1974.

In summary then, Mr. McDaniel estimated the total reserves of propane in Alberta to be:

	Millions of Barrels		
	Existing Conditions	Increment Due to Deep-Cut Facilities	Total
From established gas reserves	324	66	390
From two years growth of gas reserves	28	20	48
Sub-Total	352	86	438

	Millions of Barrels		
	Existing Conditions	Increment Due to Deep-Cut Facilities	Total
Sub-Total (brought forward)	352	86	438
From growth of gas reserves during the period 1966-1974	120		120
From gas to be discovered beyond 1974 to the ultimate of 80 trillion cubic feet	169		169
Sub-Total	289		289
TOTAL PROPANE RESERVES	641		727

A detailed discussion of the applicant's estimate of reserves is presented in Appendix A.

Availability of Propane

In addition to his figures on recoverable reserves, Mr. McDaniel also presented estimates of the amount of propane that he expected to be available annually in Alberta during the period 1964 to 1996. He estimated annual production would be some 4.8 million barrels in 1965, increasing to 10.1 million barrels by 1996. The forecast assumed that in addition to the plants now producing or about to produce propane, deep-cut facilities would be installed in the Harmattan area plant, facilities to recover 75 per cent of the propane in the gas stream would be built in 1967 in the Carstairs plant, and facilities would be built to recover propane in fields not now producing gas but from which gas will be required to meet the needs of Alberta and the present permit commitments. His availability forecast is consistent with

his estimate of 438 million barrels as the recoverable reserves of propane. However, not all of the 438 million barrels will be produced during the period 1964 to 1996.

Mr. McDaniel recognized that the present permits for the removal of gas will expire before the end of his propane forecast period. Nevertheless, the forecast assumes that removal of gas would continue after the expiry dates specified in the permits and that propane would continue to be produced in the fields expected to supply the extended permits.

Mr. McDaniel estimated that the production of propane from the Harmattan area plant from which the applicant proposes to remove propane, will be 1,350,000 barrels in 1967 decreasing to 686,000 barrels by 1984.

Demand for Propane

The applicant presented a study by Dr. E. C. Sievwright, a consulting economist, on the requirements for Alberta propane, which covered a period extending until 1996.

1. Alberta Requirements

At the hearing, Dr. Sievwright indicated he placed considerable importance on the fact that the forecast of demand for propane in Alberta was prepared with the assistance of information supplied by Canadian Hydrocarbons, who served over fifty per cent of the Alberta market. He considered a market sample of this proportion as particularly representative of the industry. Dr. Sievwright divided the market into three main categories: LPG distributors, petrochemical and miscible flood, each of which was considered separately.

The LPG distributor's market was subdivided into domestic, commercial, industrial and carburetion sectors. The forecast of domestic consumption was based on a review of the economic factors involved and on consultations with the applicant, with particular consideration given to population trends. A prediction was made of the number of households to be served by propane. Domestic consumption was forecast by applying an estimated constant average household heating consumption level of 1,400 gallons per year and an estimated average consumption for other uses ranging from 200 to 400 gallons per year, to the forecast of households using propane, which resulted in an anticipated increase from an estimated 2,622 barrels per day in 1966 to 4,585 barrels per day in 1995.

The forecast for commercial, industrial and carburetion consumption of propane was based primarily on discussions with the applicant, and identical growth rates were postulated for each category of use, at 7 per cent per annum until 1970, followed by 5 per cent thereafter. Consequently, commercial consumption was forecast to increase from an estimated 1,286 barrels per day in 1966 to 5,600 barrels per day by 1995, industrial consumption from 359 barrels per day to 1,565 barrels per day, and carburetion consumption from 335 barrels per day to 1,470 barrels per day. In testimony, Dr. Sievwright stated that he considered recent developments in the carburetion market might result in the growth rate postulated for this category being too low.

In summary, LPG distributors total demand was expected to expand from an estimated level of 4,602 barrels per day in 1966 to 13,260 barrels per day in 1995.

The forecasts of petrochemical demand and miscible flood demand both relied upon, with slight modifications, the Board estimates published in the 1961 Foothills report.(1)

In total, Dr. Sievwright estimated Alberta demand for propane would rise from 9,802 barrels per day in 1966 to 29,460 barrels per day in 1995, resulting in overall requirements for the 30-year period, 1966 to 1995, amounting to some 202 million barrels.

2. Other Requirements

The Canadian Hydrocarbons forecast gave consideration to propane requirements in "fringe" areas of British Columbia, and for Pacific Petroleum Ltd.'s Empress Plant servicing markets to the east of Alberta.

When questioned as to whether it was appropriate to include the requirements for fringe areas as part of the demand for Alberta propane, Dr. Sievwright replied that he followed the precedent set by the Board in previous reports. The area considered comprised approximately Census Divisions One and Two of British Columbia. Rates of growth for the domestic, commercial, industrial and carburetion categories of use were estimated, based on actual experience, principally of the applicant. The annual rate of growth of the industrial and carburetion categories over the years from 1965 to 1970 was high, at a level of twenty-five per cent, which was intended to reflect activity associated with the dam and tunnel construction projects planned for the region. In total, con-

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(1) Report to the Lieutenant Governor in Council with respect to the Application under The Gas Resources Preservation Act, 1956, of Foothills Pipe Lines Ltd. June, 1961.

sumption was expected to expand from 300 barrels per day in 1966, to 1,120 barrels per day in 1995.

The requirements of those markets east of Alberta supplied through the facilities of the Pacific Petroleums Ltd. plant at Empress, Alberta, were expected to grow from 1964 to 1969, by which time the maximum volumes authorized in the permit acquired by Pacific Petroleums Ltd., of 9,600 barrels per day, would be reached. These volumes were assumed to continue as a requirement after 1981, the year the permit terminates, until 1996. At the hearing, Dr. Sievwright indicated that the period of escalation from 1964 to the point at which the maximum permit volumes are reached in 1969 would seem to be conservative. He justified the extension of the Pacific Petroleums permit beyond 1981 on the ground that it was likely that the plant and pipe line facilities would remain in use beyond that time.

The combination of British Columbia fringe area requirements and shipments from Pacific Petroleum's Empress plant resulted in a forecast increase of other requirements from an estimated 6,800 barrels per day in 1966 to 10,720 barrels per day by 1995. The required amounts over the 30-year period, 1966 to 1995, total some 111 million barrels.

In summary, Dr. Sievwright anticipated that the Alberta and other requirements for propane would increase from an estimated 16,602 barrels per day in 1966 to 40,180 barrels per day by 1995, resulting in total requirements for the 30-year period, 1966 to 1995, amounting to some 313 million barrels.

Surplus

Canadian Hydrocarbons' assessment of the overall supply-demand balance for propane assuming that in addition to the established reserves of gas, gas to be discovered in the next two years is used, indicated a surplus of 39 million barrels, or some 125 million barrels if deep-cut facilities were to be installed in all plants. The surplus which the Board compiled from data presented by the applicant at the hearing, was determined in the following manner:

	Millions of Barrels	
Reserves	Existing Conditions	Deep-Cut
From established reserves	324	390
From two years growth of gas reserves	28	48
Total Reserves	352	438
Demand (1966-1995)		
Pacific Petroleums Ltd. from Empress plant, assumed to extend to 1995	103	
Alberta thirty-year requirements	202	
Fringe area requirements (south-eastern British Columbia)	8	
Total Demand	313	
SURPLUS	39	125

Summary

Canadian Hydrocarbons contended that,

(a) in view of the large surplus in the recoverable reserves of propane over that required for the con-

sumers of the Province for the next thirty years and the present permit commitment, and

(b) since the volume of propane that can be produced annually from established reserves and from reserves to be discovered during the next two years exceeds the forecast thirty-year demand of Alberta, the markets adjacent to Alberta supplied from Alberta sources, and the present permit commitment, and

(c) because it is in the public interest,

the Board grant the permit as applied for.

IV SUBMISSION OF THE BRITISH AMERICAN OIL COMPANY LIMITED

Application

British American applied to the Board for a permit authorizing it to remove propane from Alberta for sale in Ontario during a ten-year period commencing November 15, 1965. Specifically, the applicant proposes to remove,

(a) an annual average of 2,000 barrels per day,

(b) 730,000 barrels annually, and

(c) 7,300,000 barrels during the ten-year period.

The propane to be removed is owned by the applicant and would be transported by railway tank car from gas processing plants operated by the applicant. The propane would be shipped primarily from the Rimbey plant. However, some would be taken from the Pincher Creek and Nevis plants.

Reserves of Propane

British American estimated the recoverable reserves of propane based on its estimates of the present established reserves of gas in Alberta as of January 1, 1965, to be some 449 million barrels. In addition, British American estimated that some 277 million barrels of propane would be available from gas to be discovered during the next ten years. The estimate was based on the long term growth rate of 2.5 trillion cubic feet per year. The applicant contended that "in view of the past trend in gas reserve growth, and the excellent geologic prospects for gas in Alberta, the past trend can be confidently projected for a ten-year period in determining the availability of propane."

Unlike Canadian Hydrocarbons, British American did not present separate estimates of the reserves of propane that could be recovered if the established reserves of gas were processed assuming recoveries now being experienced or assuming deep-cut facilities.

British American's estimate consisted of the following categories:

	Millions of Barrels
Existing and proposed plants(1)	305
Foothills Division of Alberta Gas Trunk Line Company Limited(2)	50
Future plants(3)	94
FROM ESTABLISHED RESERVES	449
From ten years growth of gas reserves	277
TOTAL PROPANE RESERVES	726

(1) Plants now recovering propane and plants being constructed or where plans for the installation of facilities are known.

(2) British American assumed a plant would be built late in 1966 to reprocess gas passing through the Foothills Division of the Alberta Gas Trunk Line Company Limited gas transportation system.

(3) Potential plants in fields not now producing nor under gas purchase contracts.

Availability of Propane

In addition to its estimate of recoverable reserves, the applicant estimated the availability of propane would increase from some 23,200 barrels per day in 1965 to some 42,400 barrels per day in 1976. These volumes of propane consist of production from existing plants, from a plant expected to be built on the Foothills Division of Alberta Gas Trunk Line Company Limited, from plants expected to be built in fields now shut in, and from plants constructed to process a portion of the gas expected to be discovered during the ten years 1965 to 1974. British American's availability forecast is consistent with its estimate of 726 million barrels as the recoverable reserves of propane, but not all of the 726 million barrels would be produced in the period 1965 to 1976. British American expressed the belief that additional propane would be available as new permits for the removal of gas from Alberta are authorized in the future.

British American did not make estimates of the quantity of propane that would be available during a full thirty-year period. It made estimates for only a twelve-year period, 1965 to 1976, which is slightly longer than the period during which it expected

to remove propane, 1965 to 1975. The applicant contended that if the propane was not removed during this period it would remain in the gas stream to be sold as gas and would not be available to supply markets after the ten-year period.

The volume of wholly owned propane available from the three plants, Rimbey, Nevis and Pincher Creek, was estimated by the applicant to average some 2,370 barrels per day during the ten-year period for which the permit was requested.

Details of the applicant's estimate of the reserves and availability of propane are presented in Appendix A.

Demand for Propane

1. Alberta Requirements

British American divided the Alberta demand for propane into four components: LPG distributors in Alberta, serving domestic, commercial, industrial and carburetion requirements, petrochemical feedstock; miscible flood and miscellaneous use.

LPG distributor's requirements were considered within the framework of a study embracing overall energy requirements in Alberta, the details of which were not presented in the submission. The study took cognizance of such factors as population growth, age distribution, urban and rural distribution, industrial development and the competitive effects of different fuels.

Primary importance was accorded to sales to residential and commercial customers, which were estimated as comprising 90 per cent of this market. The estimated demand of 4,300 barrels per day in 1966 was expected to increase at an average rate of 6 per

cent per annum, reaching a level of 7,600 barrels per day in 1976. These figures indicated a further substantial growth of propane consumption in rural areas, although not of the same magnitude as experienced in recent years. Industrial and carburetion uses were expected to exhibit significant growth rates, but from a relatively small initial consumption level. A review of population trends and urbanization indicated the probability of further market growth after 1976. A three per cent rate was postulated as reasonable between 1976 and 1995.

Petrochemical demand for propane feedstock was forecast to rise at a constant rate of 5 per cent per annum. No provision was made for new plants. Consequently, demand was estimated to grow from a level of 3,600 barrels per day in 1966, to 5,600 barrels per day by 1976, and to increase at 5 per cent per annum thereafter.

British American expected the current decline in propane requirements for purposes of miscible flood would continue until 1966. No demand was expected in 1967 and 1968. Subsequently, the market was assumed to build up again when fields yet to be developed and suitable for miscible operation would become available for flooding. A demand of 1,900 barrels per day was assumed to commence in 1969, and was held constant over the remainder of the forecast period.

Miscellaneous use included plant consumption, plant losses, refinery consumption and "other". It was anticipated this would provide a constant demand of 1,200 barrels per day from 1966 to 1995.

In summary, British American estimates total Alberta requirements over the thirty-year period, 1966 to 1995, to be some 211 million barrels.

2. Other Requirements

No consideration was given to propane requirements of areas adjacent to Alberta. At the hearing, the witness for the applicant indicated he believed that no special status should be accorded to such "fringe" areas. However, consideration was given to the requirements under the permit issued to Pacific Petroleums Ltd. The maximum permit volume of 9,600 barrels per day was anticipated to be achieved in 1966, and this rate was extended until 1981, when the permit is scheduled to terminate. Total other requirements were therefore estimated by British American to be some 56 million barrels over the thirty-year period, 1966 to 1995.

In summary, British American forecast that Alberta and other requirements for propane would amount to some 267 million barrels over the thirty-year period 1966 to 1995.

Surplus

British American's assessment of the supply-demand balance for propane in Alberta indicated a surplus of some 453 million barrels. The surplus was determined in the following manner:

Reserves	Millions of Barrels
From established gas reserves	449
From ten years growth of gas reserves	277
Total Reserves	726

	Millions of Barrels
Total Reserves (brought forward)	726
Demand	
Alberta requirements and present permit commitment	
1965 to 1976	97
1977 to 1995	176
Total Demand	273
SURPLUS	453

British American's assessment of the availability of propane and the requirements for propane in Alberta and the present permit commitment shows a surplus, which for 1965 was estimated to be 5,900 barrels per day increasing to 16,500 barrels per day in 1976, the first year after the requested permit expires.

Summary

British American contended that,

(a) in view of the surplus in reserves required to satisfy the thirty-year needs of Alberta and the present permit commitment, and

(b) in view of the surplus in the availability of propane in each of the ten years over which the permit was requested, and

(c) because the volumes desired to be removed are much less than either surplus,

the Board should grant the permit as applied for.

V SUBMISSIONS OF INTERVENERS

As noted elsewhere in this report there were no interveners

at the British American hearing. This section consequently is confined to a review of interventions upon the Canadian Hydrocarbons application.

1. Alberta and Southern Gas Co. Ltd. and Alberta Natural Gas Company

These companies registered as interveners at the Canadian Hydrocarbons hearing, but did not participate further.

2. The British American Oil Company Limited

At the Canadian Hydrocarbons hearing, Mr. Winterton, for British American, cross-examined some of the witnesses and presented argument.

British American's concern was for the supply of condensate for its Calgary refinery. It argued that, as a result of the decision in June, 1961, on an application by Britamoil Pipe Line Company Limited for a permit for a pipe line from Pincher Creek to Calgary, a pattern for the movement of condensate within the Province had been set, whereby condensate from the Pincher Creek-Waterton area moved to the United States and condensate from central Alberta moved south to meet Calgary requirements and north to meet Edmonton requirements or to be forwarded to extraprovincial markets. British American's Calgary refinery now receives approximately 2,000 barrels a day of condensate from Harmattan. Mr. Winterton argued that if a shortage of condensate developed in the Calgary area it would have to look for a supply to other fields which could be expensive and, in the absence of existing pipe line facilities, might be beyond economic reach.

British American did not object to the Canadian Hydrocarbons application, but asked that the Board, if it should grant a permit to the applicant, give serious consideration to the need of the Calgary area for a supply of condensate.

3. Chemcell (1963) Limited

Chemcell owns and operates a petrochemical plant near Edmonton, and is currently the sole consumer of propane as a petrochemical feedstock in Alberta. Its witness at the Canadian Hydrocarbons hearing, Mr. J. A. Relf, presented a forecast of the amounts of propane the plant would require in each year from 1965 to 1978.

In argument, Mr. Relf expressed Chemcell's concern for the long range availability of propane in Alberta. Chemcell asked that its requirements be carefully considered in any decision on the application.

4. Cigas Products Ltd.

Cigas participated in all phases of the Canadian Hydrocarbons hearing, and, as additional information was brought forth, altered its position with respect to the application to some extent during the course of the proceedings.

This intervener's expressed purpose in appearing was to establish a position for itself which will give it an opportunity to bid freely for Alberta propane.

At the hearing and before the Cigas submission was presented, the Board ruled that matters concerning the marketing of propane after it had left the Province were beyond the scope of its proper concern.

In its submission, Cigas stated that the applicant should be required to provide the particulars regarding prices that had been blanked out in copies produced by the applicant of the letter agreements under which it proposed to buy propane at the Harmattan area plant. It stated that wording of the blanked out provisions would possibly affect the interpretation of the letters, and that use of different prices in the different blanks occurring in the clause setting out what would be paid for propane which was in excess of what the applicant would be required to take and pay for and which the applicant would sell at the producer's direction, might result in realization of an override by Canadian Hydrocarbons on sales of such propane. The submission stated that the letter agreements did not create a legal relationship between the applicant and the producers and were unenforceable. Cigas, in its submission found further fault with the letter agreements in that they contain no firm commitment to make any of the plant's propane available for local distribution.

The information given by Canadian Hydrocarbons during the hearing which affected Cigas' position with respect to the application was as follows:

(1) The proposed pipe line would be a common carrier.

(2) There would be sufficient flexibility or capacity in the pipe line to make it available for marketers or producers other than the applicant.

(3) Different prices were not used in different parts of the letter agreements.

(4) Hydrocarbons Pipelines Limited would operate terminal

facilities subject to published charges.

(5) The provisions of the formal contracts for sale of propane at the Harmattan area plant would be essentially those of the letter agreements.

(6) Clarification of the question of the availability of propane in the pipe line for sale from the producers.

When the Cigas witness, Mr. G. T. Hefter, was being cross-examined, he said Cigas did not object to the application "as such", and as a result of the first three of the above statements he had no further questions. In presenting argument on behalf of Cigas, Mr. Montgomery referred to all of these statements. He submitted that to ensure that some of these disclosures are made firm, if a permit were granted, it should not be issued until formal, executed contracts, as contemplated by the letter agreements, are submitted to the Board.

5. Mountain Pacific Pipeline Ltd.

Mountain Pacific submitted that the application of Canadian Hydrocarbons should be dismissed.

This intervener said the letter agreements under which the applicant proposed to buy propane at the Harmattan area plant do not create a legal relationship between the applicant and Shell Canada Limited or Canadian Superior Oil Ltd. It pointed out that the letter agreements were by their terms subject to a formal contract being acceptable to and executed by the parties and subject to approval being obtained from owners of the plant to expand the facilities to produce the volume of propane provided for. In the case of the Canadian Superior letter, it is predicated, according

to the Mountain Pacific interpretation, upon obtaining authority from minority interest owners to sell their product.

Mountain Pacific pointed out that the applicant had not submitted any evidence of other agreements by which it would purchase or acquire propane for which it seeks a permit.

The intervener submitted that, since Canadian Hydrocarbons does not have the right to purchase the propane, it has not qualified itself under section 5 of The Gas Resources Preservation Act, 1956, as one who may apply for a permit.

Mountain Pacific pointed out that even if the letter agreements entitled the applicant to purchase Shell and Canadian Superior propane, it would have contracted for only about forty per cent of the requested permit volume. It was argued that to grant a permit for approximately two and a half times the volume the applicant purports to control would tie up the resources of the Province to an unjustified degree, and place the producers of the Province at the mercy of the applicant.

VI BASIS OF CONSIDERATION

Protection for Alberta Consumers

The Gas Resources Preservation Act, 1956, states that "the Board shall not grant a permit for the removal of any gas or propane from the Province unless in its opinion it is in the public interest to do so having regard to

(a) the present and future needs of persons within the Province, and

(b) the established reserves and the trends in growth

and discovery of reserves of gas or propane in the Province."

As applied to gas, the Board has always assessed the needs of persons within the Province for a thirty-year period. It is the practice of the Board to ensure that the reserves of gas (established reserves and two years growth of gas reserves) must be sufficient to supply the annual and peak day requirements during each of the thirty years.

Similarly, in the two previous applications(1)(2) for the removal of propane from the Province, the Board considered that the reserves and supply of propane should be sufficient to meet Alberta's annual and total requirements for a full thirty years. The sources of supply were plants then recovering propane, plants expected to process gas from shut-in fields, and plants expected to process the two years growth in the reserves of gas.

Canadian Hydrocarbons at the hearing of its application did not discuss the philosophy of protecting for the thirty-year requirements of the Province although it did include a thirty-year supply-demand balance for propane. The balance incorporated more than the two years growth of gas reserves normally used by the Board in assessing the available surplus. Mr. McDaniel, a witness for Canadian Hydrocarbons, stated that a portion of this

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(1) Report to the Lieutenant Governor in Council with Respect to the Application under The Gas Resources Preservation Act, 1956, of Pacific Petroleums Ltd. August, 1962.

(2) Report to the Lieutenant Governor in Council with Respect to the Application under The Gas Resources Preservation Act, 1956, of Foothills Pipe Lines Ltd. June, 1961.

future propane could result from increased production from established gas reserves and that in his opinion less than two years growth of gas reserves would be required to balance the supply and demand.

British American at the hearing of its application presented a supply-demand balance for only the period of its requested permit, 1965 to 1976. It did include a total reserve-demand balance reflecting the thirty-year requirements of the Province and the existing permit commitment. It included in the total reserves the propane expected to be recoverable from ten years growth of gas reserves. Mr. Janisch, a witness for British American, stated that his company believed it would be reasonable to consider reserve growth over the same time period for which requirements were being considered. He further stated that this may not be practical for gas reserves, but that the growth trend could be confidently projected for a ten-year period in determining the availability of propane.

The Board has reviewed its policy in the light of evidence presented at the hearings and remains convinced that it is proper to protect for the Province's future propane requirements for a thirty-year period using the propane recoverable from the established gas reserves and from two years growth of gas reserves. However, there are two serious difficulties in applying such a policy. One of these is that the reserves and annual production of propane expected in the Province depend to some extent on market demand for it. The other is that the year to year pattern of availability of propane is closely related to the pattern of

production of gas and, therefore, to the rate and duration of removal of gas from the Province.

With respect to the affect of market demand on the reserves and the annual production of propane, the Board believes it proper for it to look at both the reserves and annual production which would be expected from existing processing facilities and the somewhat greater reserves and annual production which it believes will materialize given sufficient market demand, with greater weight given to the latter figures. The greater volumes reflect the inclusion of future plant facilities including deep-cut recovery facilities at existing processing plants.

Dealing with the reserves themselves, the Board considers that the first test of a removable surplus is that the total reserves should exceed the estimated thirty-year requirements of the Province.

Turning to the question of the year by year availability, the Board believes that, so far as it is practical for it to do so, it should ensure that the propane proposed to be removed will be surplus on a year to year basis as well as in the aggregate. This means analyzing the production and the Alberta requirements of propane by years over a long term. In the case of gas the Board has carried its availability (deliverability) analysis for the full thirty-year period. In the case of propane, much of the production is related to gas production for removal from the Province under permits to terminate within the next twenty to twenty-five years. Consequently, the rate of propane production there-

after will depend to a considerable extent upon whether or not such permits will be renewed and a meaningful year by year production estimate is not practical.

In addition, unless the production of gas reserves containing propane is deferred, propane production (as distinct from recovery) is almost directly related to the demand for gas. Unless the propane not normally recovered is recovered and stored, it will be disposed of in the gas stream either within or beyond the Province. (The Board has the authority to require the removal within the Province of the propane from the gas moving to extraprovincial markets.) A study of the economic feasibility of long term storage of propane or the deferment of significant amounts of propane production is very complex when related to a period many years in the future, and the Board believes little would be gained by such a study unless it was critical to the decision.

For these reasons, the Board is of the opinion that a year by year supply-demand balance need be completed for only the period of the requested permit and that such a balance provides a second test of effective protection for Alberta consumers. Where the year by year analysis results in significant deficiencies during the period of the requested permit, the Board would not grant the permit - at least in the full amount or for the entire term applied for.

Where the analysis shows that the propane is clearly surplus to the year by year requirements for the term of its proposed removal, the Board would apply a final test as a substitute for a year by year appraisal for the remainder of the thirty-year period.

The Board believes that the reserves remaining at the end of the period of the proposed removal should substantially exceed the total requirements for the remainder of the thirty-year period. The Board recognizes that all of the then remaining reserves could not normally be produced during the remainder of the thirty-year period, but it is of the opinion that, possibly with the assistance of deferment of production and some use of storage during both the period of the proposed removal and the remainder of the thirty-year period, a substantial portion of these reserves could be so produced if the propane was required to serve the Alberta market.

In the case where the reserves remaining at the end of the period of the proposed removal are less than the total requirements for the remainder of the thirty-year period, the Board would not grant the permit as applied for even though the requested quantities may be surplus to the year by year requirements unless it is satisfied that storage or deferment of production during the period of the proposed permit is not feasible and that the propane reserves would in any case be produced and disposed of prior to the period of the deficiency. Such a decision would involve a detailed analysis of the feasibility of propane storage or of the deferment of propane production.

Fringe Markets

Canadian Hydrocarbons included in its requirements for Alberta propane the requirements of the East and West Kootenay areas of British Columbia. Dr. Sievwright indicated that the only

reason for doing so was precedent. He did not consider it to be properly within the requirement of Alberta for propane.

British American in its assessment of the supply-demand balance for Alberta propane did not include the requirements of areas outside of Alberta. However, Mr. J. West, for the applicant, stated that "if there is a demand there, and people are moving product out of the Province, and it is a requirement that shipments out of the Province be subject to regulation, then we think it may have to be considered in the overall picture, whether it be a fringe area on any side of the Province."

When it last assessed the supply-demand balance for Alberta propane (Foothills Report, June 1961) the Board included in the requirements which must be satisfied, the requirements of south-eastern British Columbia and those of western Saskatchewan, since these areas were supplied from Alberta sources. These were referred to as the fringe markets.

The Board has reconsidered its policy and, having regard to the provision of The Gas Resources Preservation Act, 1956, which states that the Board is to have regard for "the present and future needs of persons within the Province," believes that it is not proper to include the needs of the areas of Canada adjacent to Alberta in the requirements which must be satisfied before removal of propane is permitted. It has not done so in its present assessment of the supply-demand balance for Alberta propane.

Moreover, the shipment of propane by pipe line from the Empress plant through Saskatchewan provides propane in areas for-

merly supplied from other Alberta sources. The volumes shipped through this pipe line have been included as a permit commitment in the requirements for Alberta propane presented in this report. Also, the Canadian Hydrocarbons project, if approved, would make propane available in that area of British Columbia previously included in the requirements for Alberta propane.

Qualification of the Applicants

Canadian Hydrocarbons and British American each claim to be a person who under section 5, subsection (1) of The Gas Resources Preservation Act, 1956, may make an application for a permit authorizing the removal of propane from the Province. Section 5 reads as follows:

"5. (1) A person

(a) who produces or has the right to produce gas or propane within the Province,

(b) who purchases or otherwise acquires or has entered into a contract to purchase or otherwise acquire property in gas or propane within the Province, or

(c) who transports, or has entered into a contract with the owner, producer, purchaser or acquirer of gas or propane undertaking to transport, gas or propane produced within the Province,

and who proposes to remove gas or propane, or cause it to be removed, from the Province may make application to the Board for a permit authorizing the removal of gas or propane.

"(2) With the approval of the Lieutenant Governor in Council the Board may authorize and empower a person not qualified to make an application under subsection (1) to apply to the Board for a permit authorizing the removal of gas or propane from the Province upon such terms as seem proper to the Board."

The British American application was for the removal from the Province of propane of which the applicant will be the producer and owner. The qualification of this applicant consequently was not a matter of question. However, this was not true in the case of Canadian Hydrocarbons and the following discussion of qualification applies only to Canadian Hydrocarbons.

Mr. D. R. Williams, Jr., a director of Canadian Hydrocarbons and one of its witnesses, testified that the applicant is a producer of propane at the Acheson plant, that it is a large and continuous buyer of propane in Alberta, and that it has a fleet of rail cars and transport trucks in which it transports propane in Alberta.

In support of its application, Canadian Hydrocarbons produced two letter agreements, one with Canadian Superior Oil Ltd. and one with Shell Canada Limited. In form the letters were substantially the same, except that the Canadian Superior letter concerned the sale of the propane of minority interest owners as well as that of Canadian Superior. The parts of these documents, as they appear in the Canadian Superior letter, which gave rise to argument concerning the effect of the letter agreements on the application of section 5 of the Act, read as follows:

From clause 2:

"Based upon latest production figures available, your estimated share of production of propane in each year of the term of this contract, plus such product of other minority interest owners which you anticipate you would be authorized to sell and upon which this agreement is predicated, subject to reservations set forth above, would be as follows:"

From clause 4:

"In the event we are unable to reach agreement as to price prior to September 30th, 1965, then the purchase and delivery of product would be on the following terms:-"

Clause 5:

"Notwithstanding the provisions of Paragraph 4 hereof, this entire offer is subject to

(a) Canadian Hydrocarbons Limited and Hydrocarbons Pipeline Limited obtaining approval from the appropriate governmental authorities for the export of the product from the Province of Alberta and the construction of the said Pipeline and storage facilities which we have discussed with you;

(b) the completion of construction of the Pipeline and storage facilities; and

(c) a formal contract being acceptable to and executed by both parties hereto by September 30th, 1965 with terms and conditions mutually acceptable to both parties.

(d) Approval being obtained from the owners of the Plant to expand the facilities of the Plant to pro-

duce sufficient volume of propane to enable you to supply the volumes provided for above."

Mr. Williams stated under examination that the letter agreements were the normal type of commitment at that stage, that their terms were the essential terms which would be embodied in the formal contract and that he did not think the producers in question would have signed them if they would be willing to withdraw from the agreements for some inconsequential reason.

As rebuttal witnesses, the applicant called Mr. E. R. Barnett, vice-president of Canadian Superior, and Mr. W. M. Luthy, manager of transportation and supply for Western Canada of Shell. Mr. Barnett stated that the letter agreement signed by his company was entered into sincerely and that it was common for the company to sign letters of intent and to proceed on them. Cross-examined as to the result if minority owners referred to in the letter declined to allow Canadian Superior to sell their propane, Mr. Barnett said he imagined the final agreement would take into consideration the material that they could get committed to it. Mr. Luthy said that Shell had entered into its letter arrangement in good faith and was bound by it. He said that, at early stages of proceedings, such informal arrangements were normal.

1. Views of Interveners

Mountain Pacific maintained throughout the hearing that Canadian Hydrocarbons was not qualified as an applicant because the Canadian Superior and Shell letters were not legally effective contracts, and because by section 5 of the Act the applicant, unless

he has been authorized by order under subsection (2) to apply, must produce, purchase, contract for or transport that propane which he proposes to remove from the Province. Mountain Pacific accordingly asked that the application be dismissed.

At the opening of the hearing, Cigas also claimed the letters in question were mere letters to agree and not firm contracts. It asked that the hearing be adjourned forthwith until the applicant could place firm contracts before the Board. The Board then declined to follow such a course, and stated that, as the Board saw it, the letters, on the surface at any rate, qualified Canadian Hydrocarbons to submit an application. However, as Canadian Hydrocarbons had made copies of the letters available only after the final date for filing interventions, the Board decided that, after the applicant had presented its evidence on requirements and reserves, the hearing would be adjourned to the following week to permit the filing, in the meantime, of supplementary or additional interventions based on the letter agreements.

In arguing against the effectiveness of the letter agreements, Mountain Pacific said that, although the use of letters of intent by industry was not unusual and may be binding, the parties to these particular letters saw fit to include conditions and safeguards which nullified any legal or binding effect that the letters otherwise might have. Reference was made to clause 5 of the letters, and particularly to subclause (c).

In the Canadian Superior letter, a further provision to which Mountain Pacific referred occurs in the part of clause 2 setting forth estimated shares of production of Canadian Superior and of

the minority interest owners. Because reference to the latter shares is modified by the phrase "which you anticipate you would be authorized to sell and upon which this agreement is predicated," Mr. Ballem, for the intervener, submitted that this meant "the letter stands or falls upon whether or not Canadian Superior is authorized to sell the volumes of the other minority interests."

Mountain Pacific further submitted that where section 5, subsection (1) of the Act requires an applicant to produce, purchase, contract for or transport gas or propane, it must be taken to mean the gas or propane which is the subject matter of his application. If such a restriction is not implied the effectiveness of the Act in securing the conservation and effective utilization of the product would be reduced. Further, it would mean that almost any home owner in the Province would qualify as an applicant, and subsection (2), to permit authorization of an application by a person who could not qualify under subsection (1), would be superfluous.

2. Views of Canadian Hydrocarbons

When the effectiveness of the letter agreements as contracts was first brought up at the opening of the hearing, Mr. MacKimmie, for Canadian Hydrocarbons, argued that there was no statutory obligation upon the Board to examine the applicant's contractual arrangements. A consideration of the documents was a matter of the weight of the evidence rather than of the qualification of the applicant or the jurisdiction of the Board.

In argument at the conclusion of the hearing, Mr. MacKimmie said that the parties to the letters regarded the commitment as

firm and that it was not the Board's function to judge the validity of contracts. He said the Board "acts upon probabilities and what, in its judgment, it thinks is sufficient to satisfy it as to the requirements."

With regard to the question of whether the propane, the production, purchase, contracting for or transportation of which would qualify an applicant, must be the propane he proposes to remove from the Province, Canadian Hydrocarbons claimed this restriction had been eliminated by amendment of section 5.(3) Now if the provision is interpreted literally it could be any propane and Canadian Hydrocarbons would be qualified apart from its arrangements for purchase at the Harmattan area plant. Mr. MacKimmie submitted that it should be interpreted and applied so that a person engaged actively in the propane industry, not a "fly-by nighter", would be accepted as an applicant.

3. Views of the Board

The Board is of the opinion that, where an application is made under section 5, subsection (1) of the Act, it is bound to satisfy itself that the applicant has the right, as a result of ownership, contract or otherwise, to apply.

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(3) As enacted in 1956, section 5 authorized application by a person who produces, purchases, acquires or contracts to purchase or acquire gas in the Province and "who intends to remove any part of such gas, or cause it to be removed, from the Province." This section was replaced by a new section 5 in 1960, which was in its present form except for amendments reflecting new definitions in 1963. In the 1960 section the words quoted from the 1956 section were replaced by "who proposes to remove gas, or cause it to be removed, from the Province."

On the question of whether the gas or propane subject to ownership or contract and the gas or propane for which a permit is sought must be the same, the Board takes it that, if they are not specifically identified with each other by the wording of the section, this is to permit a degree of flexibility and, in a suitable case, to allow an application where the applicant had at the time of application rights with respect to less than all of the product to be removed. Section 9 authorizes a term or condition in a permit specifying the pool, field, area or processing plant from which a permittee may remove gas or propane, and in considering this section in conjunction with section 5, it is relevant to know the proposed permittee will be entitled to remove gas or propane from the source to be named in the permit. Consequently, the Board does not agree with Mr. MacKimmie on this point, and it expects an applicant under section 5, subsection (1) of the Act to show that he owns or has a contract relating to a significant part of the gas or propane referred to in his application.

The question of the validity as contracts within the meaning of section 5, subsection (1) of the Act of the letter agreements obtained by Canadian Hydrocarbons from Canadian Superior and Shell has given the Board considerable difficulty. It appears to the Board that these difficulties may have been created unnecessarily by the parties. Over the years, letter agreements have been submitted at hearings of applications for permits authorizing the removal of gas from the Province and have been accepted unchallenged. Such letter agreements and, indeed, formal gas sales contracts submitted for the same purpose, have ordinarily been subject

to some conditions making them subject to the issue of the necessary authorizations to allow the gas removal project to proceed. Conditions of this sort appeared in the letter agreements submitted by Canadian Hydrocarbons, and the interveners' objections did not extend to them. The Board realizes that the form and wording of letter agreements may vary widely and that such variations may have bearing on the effect of the documents. In considering the Canadian Hydrocarbons letter agreements, the Board places considerable weight on what Mr. Barnett and Mr. Luthy had to say about their companies' sincerity in signing the letter agreements and their understanding of the effect of them. When the hearing opened, the Board, as noted above, took the view that the letter agreements, on the surface at any rate, qualified Canadian Hydrocarbons to submit an application. It is now satisfied that, although the wording of the agreements leaves room for argument both for and against their validity, the parties intended and thought them to be contracts for the sale of propane and executed them believing them to be binding. Consequently the Board accepts the letter agreements as qualifying the applicant under section 5, subsection (1) of the Act.

Relationship of Volumes Under Contract to Permit Volumes and Matters Arising Therefrom

The volumes of propane which British American proposes to remove from the Province are less than the volumes which will be produced, and owned, by it at the plants named in the application. Here again, therefore, the problem of contract volumes being less than the proposed permit volumes arises, in so far as the subject

applications are concerned, only in connection with the Canadian Hydrocarbons application.

Canadian Hydrocarbons proposes to remove propane to be recovered at the Harmattan area plant for the producers, Canadian Superior, Shell and minority interest owners. Table I sets out the maximum annual volumes applied for by Canadian Hydrocarbons, the volumes expected to be produced from the plant for Canadian Superior, for Shell and for all owners (derived from tables in the letter agreements) and some calculations derived therefrom which the Board believes will be useful in this discussion.

1. Views of Mountain Pacific

On the basis of the letter agreements, Mountain Pacific calculated that, if the letter agreements were binding, they would affect only eighty per cent of the shares of production of Canadian Superior and Shell and that the applicant, therefore, could lay claim to only about forty per cent of the total volume for which it requested a permit. This calculation is confirmed by a comparison of columns 6 and 2 of Table I.

Mountain Pacific argued that if a permit for the full 15 million barrels applied for were granted to Canadian Hydrocarbons it would mean that any subsequent applicant would have to find a removable surplus over and above the 15 million barrels, even though Canadian Hydrocarbons might have no contract to acquire all of this propane or any likelihood of obtaining one. This intervener submitted that the granting of a permit for the full amount applied for would tie up the resources of the Province to an unjustified degree and place the producers of the Province at the mercy of the applicant.

2. Views of Canadian Hydrocarbons

Canadian Hydrocarbons thought it unlikely that the minority interest owners would refuse to avail themselves of a market for propane. It calculated that, after deducting 20 per cent for local use, the remaining 80 per cent of the total, when the minority interest owners share was added to those of Canadian Superior and Shell, would be 68 per cent of the volume applied for. Comparison of the totals of columns 7 and 2 in Table I gives this percentage as about 66. Further, the applicant observed that 20 per cent of the production of the plant, particularly in the earlier years, would be a large amount to dispose of on the local market. Canadian Hydrocarbons, therefore, concluded that a realistic estimate of the volume of propane that would be available to it from the Harmattan area plant as a result of the letter agreements would be 80 per cent of the volume applied for.

Canadian Hydrocarbons submitted that it would be unreasonable to expect an applicant for a permit for the removal of propane to have under contract for the term of the permit the full volumes applied for. It pointed out that an applicant for such a permit bought the product in a market that traditionally operated on the basis of short term sales and that this was preferred both by the producers and the purchasers. Similarly, the applicant would be selling in a market where short term sales are customary and where it would not be the holder of a franchise like that held by the permittee removing marketable gas. In the case of propane the future supply and the future market must remain to some extent the risk of the applicant.

This applicant suggested that, even though the volumes available under the letter agreements were less, a permit for the full volume should be considered. The better criterion was that a project should be a viable one to be operated by an experienced and reliable dealer in the product. If a permit should be granted then propane that would otherwise be lost to the Province as part of a stream of marketable gas would be recovered in new plants and the interest of the Province thus served. The applicant regarded the 15 million barrels named in its application as a modest amount.

The applicant stated that, if a permit should be granted by the Board for a volume less than that applied for, it would go ahead with the project and it would expect to be back for additional volumes when the producers built future plants making them available.

3. Views of the Board

As no policy has yet been established with regard to the balance between contract volumes and permit volumes in the case of propane, one might have regard to the policy that applies to marketable gas permits. In the case of marketable gas, the permit names as sources fields or pools in which the permittee has contracts with producers for the purchase of gas. The Board does not authorize the removal of gas in volumes in excess of those expected to be recovered from such fields or pools, and it requires the applicant to have under contract in the order of 80 per cent of the total proposed permit volumes for the full term of the permit.

If the Board were to issue a permit for the removal of propane, it would expect that the permit would name as sources the fields or processing plants in which the permittee has contracts for the purchase of propane, and would not authorize the removal of propane in volumes in excess of those expected to be recovered from such fields or plants.

The Board recognizes that there are differences in the situation that applies in the case of a propane application from that applying to a marketable gas application. Because of the historic use of short term contracts in selling propane, it may not always be reasonable to look for contracts for the full term of the permit covering as great a part of the total volume applied for. The Board anticipates, however, that, with the granting of permits for the removal of propane over a term of years and the construction of propane pipe lines, these developments may become reflected in marketing practices so that long term sales of propane by producers may become more common. In these circumstances, the Board is of the opinion that it may, for the initial years of a propane permit, allow a permittee to have less of the permit volume under contract than in the case of a marketable gas permit. However, the Board considers that it can not anticipate that beyond the initial years the supply of propane available to a permittee from the plants named in the permit will rise to meet permit volumes substantially in excess of the contract volumes shown by the permittee in his application. The Board is prepared, in the case of an application for a permit authorizing the removal of propane from the Province by an applicant who does not own or

have under contract the full volumes applied for, to grant a permit authorizing removal during the first two years of maximum volumes exceeding the established contract volumes for such years by two-thirds, and during the later years maximum volumes equal to such established contract volumes for such years plus ten per cent of them to allow for flexibility and some "spot" purchases. The two-thirds by which the permit volumes would initially exceed contract volumes is arbitrary, but is considered by the Board to be appropriate in the circumstances. Further, the Board is prepared in such a case, to allow the permittee the opportunity of satisfying it, not later than 21 months from the commencement of the term of the permit, that it has contracted for additional purchases of propane at the fields or plants named in the permit and, if this should be done, the maximum annual permit volumes for the third and subsequent years would be increased by 110 per cent of the additional volumes contracted for for such years up to a maximum normally related to the lesser of the first two years volumes. An application by the end of the 21st month of the term would allow the Board to consider it and give effect to its decision before the start of the third year of the term. All of the annual volumes would be subject to the further limitation that they shall exceed neither the volumes applied for nor the volumes which the Board expects will be recovered at the fields or plants named in the permit.

When the Board has a propane permit application under consideration, for the purpose of assessing whether or not a surplus would exist if the application were granted, the Board will con-

sider that the volumes required for the permit would be the largest volumes that the applicant could be granted in accordance with the policy set out herein, assuming that during the first 21 months of the term the permittee will produce additional contracts for the purchase of propane sufficient to justify such volumes. After a propane permit has been granted, for the purpose of calculating the permit commitment arising from it, the Board will add the maximum volumes specified in the permit for the current and remaining years of its term. During the first 21 months of the term, the Board again will consider that the volumes for the third and subsequent years to be the largest that the permittee could obtain by the production of additional contracts, and after the first 21 months of the term, the volumes determined in accordance with the original volumes contracted for, or as redetermined on the production of additional contracts, as the case may be, will be used.

Section 9 of The Gas Resources Preservation Act, 1956, in listing some of the terms and conditions that may be prescribed in a permit specifically mentions annual quantities that may be removed and maximum daily quantities. It has been the practice in permits for the removal of marketable gas to prescribe also a total permit volume. This practice also is one that is affected by differences in the situation that applies to a propane permit application as compared with a gas permit application. While some storage of produced propane may be available within the Province, its long-range use is undeveloped and likely to be limited as compared with the underground retention of gas. Further, as

was pointed out at the hearing, propane that is not recovered when the gas from which it would be taken is produced and used will not be available later. Consequently, in propane permits the Board will specify the quantity that may be removed in each year of the permit and will not specify a total permit volume. If in any year, less than the quantity specified is removed, the balance cannot be removed later under the authority of the permit.

British American stated that the application of maximum daily quantities is wholly impractical where propane is to be removed by railway tank car. The Board agrees that the setting of maximum daily quantities is unnecessary in a propane permit regardless of the means by which the propane will be removed from the Province.

In summary, it will be the Board policy, where a permit for the removal of propane from the Province is granted, to observe the following rules:

1. The permit will specify maximum annual volumes only.

2. Specified volumes shall not exceed either those applied for or those which the Board expects to be recovered from the fields or processing plants from which the permittee may remove propane.

3. Where the permittee does not own or have under contract the full volumes applied for, the permit volumes shall, subject to rule 2 above, be

(a) for the first two years of the term of the permit, 167 per cent of the volumes for such years owned or under contract, and

(b) for the third and subsequent years of the term of the permit, 110 per cent of the

volumes for such years owned or under contract.

4. Where the permittee, at the time of his application, did not own or have under contract the full volumes applied for and subsequently obtains additional contracts for the purchase of propane from the processing plants named in the permit, he may, during the first 21 months of the term of the permit, request the Board to adjust the maximum volumes for the third and subsequent years. If the Board is satisfied with the additional contracts, it may, by stipulation and subject to rule 2 above, increase the volumes specified for the third and subsequent years by 110 per cent of the volumes made available in such years by the additional contracts, but, where the volumes applied for are uniform or declining over the term of the proposed permit, the volumes so increased normally shall not exceed the lesser of the volumes specified for the first two years of the permit.

5. If in any year, less than the maximum volume of propane for that year is removed, the balance cannot be removed later.

6. In calculating the permit commitment arising from a propane permit, the Board will add the maximum volumes specified in the permit for the balance of the term of the permit. If the calculation is made in the first 21 months of the term, or is made with respect to a proposed permit to determine its effect on the surplus, the volumes used for the third and subsequent years of the term will include any increases in volumes which the permittee could obtain by producing additional propane purchase contracts.

The Board is prepared to apply the above rules regarding propane permits until the development of the industry indicates the need of a change of policy.

Applying the above to the Canadian Hydrocarbons application, the Board finds that the established contract volumes are those which will be produced for Canadian Superior and Shell at the Harmattan area plant, less the 20 per cent reserved for local sales - that is the volumes shown in column 6 of Table I. Initially the permit would authorize the removal in the years commencing on November 1, 1966 and November 1, 1967, of 776,000 barrels and 746,000 barrels, being the volumes shown for those years in column 8 of Table I and being the column 6 figures multiplied by 1.67. In each subsequent year the specified maximum volume would be that shown in column 8 of Table I. The volumes in these subsequent years would be subject to increase upon application within 21 months after the commencement of the term of the permit in accordance with the above recited rules. The resulting volumes would in each of these subsequent years be the least of

(a) 746,000 barrels (the lesser of the first year volume and the second year volume),

(b) the volume which the Board expects to be recovered from the Harmattan area plant during the year, as shown in Table A-1 in Appendix A, and

(c) the maximum volume applied for for the year, shown in paragraph 2 of the Canadian Hydrocarbons application.

These resulting volumes, and the volumes which the permit would authorize for the first two years of the term, are as follows:

For the Year Commencing	Maximum Volume
November 1, 1966	776,000
November 1, 1967	746,000
November 1, 1968	746,000
November 1, 1969	697,000
November 1, 1970	646,000
November 1, 1971	639,000
November 1, 1972	588,000
November 1, 1973 and subsequent years	540,000

Supply of Condensate for the Calgary Area

At the Canadian Hydrocarbons hearing, British American asked the Board to give consideration to the need of its refinery in the Calgary area for a supply of condensate, which it now obtains at Harmattan. The Board considers this matter strictly not relevant. The Board feels that the matter should be considered only if it is satisfied that the effect of the proposed permit would be so disruptive as to adversely affect the public interest, and it does not consider this to be the case.

TABLE I

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
YEAR	VOLUME APPLIED FOR (BARRELS)	CANADIAN SUPERIOR OIL LTD. (BARRELS)	SHELL CANADA LIMITED (BARRELS)	CANADIAN SUPERIOR AND SHELL (BARRELS)	CANADIAN SUPERIOR AND SHELL, LESS 20% (BARRELS)	HARMATTAN PLANT (BARRELS)	CANADIAN SUPERIOR AND SHELL LESS 20%, PLUS 10% (BARRELS)
1967[2]	1,225,000	348,615	232,423	581,038	464,830	1,003,800	776,266[3]
1968	1,170,000	336,329	221,769	558,098	446,478	970,900	745,618[3]
1969	1,135,000	275,526	187,319	462,845	370,276	784,800	407,304
1970	914,000	245,841	169,341	415,182	332,146	697,200	365,361
1971	812,000	229,955	160,375	390,330	312,264	646,100	343,490
1972	753,000	226,624	156,898	383,522	306,818	638,800	337,500
1973	746,000	209,436	147,514	356,950	285,560	587,700	314,116
1974	683,000	194,498	138,074	332,572	266,058	540,200	292,664
1975	632,000	194,498	138,074	332,572	266,058	540,200	292,664
1976 TO 1986[1]	630,000	194,498	138,074	332,572	266,058	540,200	292,664
TOTAL	15,000,000	4,400,800	3,070,601	7,471,401	5,977,126	12,351,900	7,094,287

(1) THE EXPECTED PRODUCTION FIGURES IN THE LETTER AGREEMENTS ENDED WITH THE YEAR 1984, BUT THE FIGURES FOR THE LATER YEARS HAVE BEEN CARRIED ON IN THE TABLE UNALTERED TO 1986.

(2) THE YEARLY PERIODS ARE THE 12 MONTHS FROM NOVEMBER 1ST OF THE PREVIOUS YEAR TO OCTOBER 31ST OF THE YEAR INDICATED.

(3) THE 1967 AND 1968 VOLUMES ARE EQUAL TO 1.67 TIMES THE VOLUMES SHOWN IN COLUMN 6.

VII FINDINGS

The Board having heard publicly the applications under The Gas Resources Preservation Act, 1956, of Canadian Hydrocarbons Limited and The British American Oil Company Limited, and having studied the evidence submitted by the applicants and the interveners at the public hearings, and having regard to the advice of its staff, to its own knowledge, and to its responsibility under the Act, finds as follows:

1. IN THE MATTER OF THE RECOVERABLE RESERVES AND THE YEAR BY YEAR AVAILABILITY OF PROPANE IN THE PROVINCE OF ALBERTA

The Board estimates the total recoverable reserves of propane in the Province of Alberta as of December 31, 1964, to be some 389 million barrels. Of this total reserve it is estimated that some 325 million barrels will be recovered from existing processing plants and some 64 million barrels will be recovered by more complete gas processing if there is sufficient demand for propane.

The Board estimates that production of propane from existing or Board approved plants will be approximately 30,000 barrels per day from 1966 to 1980 declining thereafter to some 18,000 barrels per day by 1986. The Board further estimates that if there is sufficient demand for propane additional propane recovery will occur at plants to be constructed in the future or by the installation of deep-cut facilities at existing plants in an amount of approximately 8,000 barrels per day commencing in 1968. Combining these two estimates indicates a year by year availability of propane of some 30,000 barrels a day for the years 1966 and 1967,

increasing to a level of approximately 38,000 barrels per day for the period, 1968 to 1980, and then gradually declining to about 25,000 barrels per day by 1986.

Details of the evidence and the Board's estimates of reserves and availability of propane are presented in Appendix A.

2. IN THE MATTER OF TRENDS IN EXPLORATION AND THE GROWTH OF RECOVERABLE RESERVES AND YEAR BY YEAR AVAILABILITY OF PROPANE IN ALBERTA

The Board's latest study of trends in the growth of gas reserves indicates a long term growth of 2.5 trillion cubic feet per year and a growth of 4.3 trillion cubic feet during the two year period, January 1, 1963, to December 31, 1964. The Board is confident that the Province may reasonably count on a two year growth in gas reserves of 4.3 trillion cubic feet. The Board estimates the recoverable reserves of propane associated with the 4.3 trillion cubic feet of gas to be some 43 million barrels.

The Board expects that propane production from the 4.3 trillion cubic feet will commence in 1970 at a low rate and will gradually increase to about 3,500 barrels per day by 1986.

Details of the evidence and the Board's estimates are presented in Appendix A.

3. IN THE MATTER OF THE PRESENT AND FUTURE REQUIREMENTS OF ALBERTA FOR PROPANE AND THE PRESENT PERMIT COMMITMENT

The Board estimates the requirements of Alberta for propane for the thirty-year period, January 1, 1966, to December 31, 1995, to be some 221 million barrels. For comparison the Board's report

of June, 1961, to the Lieutenant Governor in Council indicated the requirements for the thirty-year period, 1961 to 1990 inclusive, to be some 162 million barrels. A comparison of actual Alberta requirements over recent years with those predicted in 1961 indicates the original estimate was low by approximately 10 per cent. The new estimate of Alberta requirements recognizes this more rapid growth in propane consumption.

The remaining commitment, arising from the subsisting permit issued for the removal of propane from Alberta, as at December 31, 1965, is some 52 million barrels.

A discussion of the evidence and the Board's latest study concerning the future requirements of Alberta and details of the remaining permit commitment are presented in Appendix B.

4. IN THE MATTER OF THE PRESENT AND FUTURE REQUIREMENTS FOR PROPANE OF AREAS IN CANADA ADJACENT TO ALBERTA

In its June, 1961, report to the Lieutenant Governor in Council, the Board, in assessing the requirements for Alberta propane, included in the requirements the estimated consumption of southeastern British Columbia and western Saskatchewan since these areas were supplied from Alberta sources. The Board has reconsidered its policy and, having regard to the provisions of The Gas Resources Preservation Act, 1956, finds that it is not proper to include in the requirements which must be satisfied before removal of propane is permitted the requirements of areas of Canada adjacent to Alberta.

Details of the evidence and Board views are presented in Section VI.

5. IN THE MATTER OF PROTECTION FOR ALBERTA REQUIREMENTS

The Board believes that it is proper to provide for the Province's future propane requirements for a thirty-year period from the propane recoverable from the established gas reserves and the two year growth of gas reserves. This is the same policy that the Board applies in protecting the Province's gas requirements. The application of this policy to propane is more complex since the reserves and the annual production depend to some extent on the market demand for propane and since the year by year availability of propane depends, to a considerable degree, on the rate and duration of removal of gas from the Province.

With respect to the effect of market demand on the reserves and on the annual production, the Board believes that, while it is proper to have regard to both the reserves and annual production expected from existing facilities and the somewhat greater reserves and annual production which it believes will materialize given sufficient market demand, considerably greater weight should be given to the latter figures.

The Board considers that the first test of a removable surplus is, that the propane recoverable from the established gas reserves and two years growth in the gas reserves should exceed the estimated thirty-year propane requirements of the Province and the subsisting permit commitment.

A second test of a removable surplus relates to the year by year availability of propane. The Board believes that the

expected production of propane in the Province should exceed the Alberta requirements and subsisting permit commitments during each year of the term of the requested permit.

At this time, a meaningful analysis of the year by year availability of propane beyond the term of the present gas removal permits is not practical. As an alternative to such an analysis and as a third test of a removable surplus, the Board believes that the propane reserves remaining at the end of the term of the requested permit should substantially exceed Alberta's total propane requirement for the remainder of the thirty-year period and any remaining permit commitment.

Details of the Board's views are presented in Section VI.

6. IN THE MATTER OF THE MEETING OF THE 1966-1995 REQUIREMENTS OF ALBERTA, TOGETHER WITH THE PRESENT PERMIT COMMITMENT AND THE RESULTING SURPLUS

Having regard to the 325 - 389 million barrels of propane estimated to be recoverable from established gas reserves, the 43 million barrels of propane estimated to be recoverable from two years growth in gas reserves, the thirty-year requirements of Alberta of 221 million barrels of propane, and the present remaining permit commitment of 52 million barrels, the Board finds that there is an overall surplus of 95 - 159 million barrels of propane. The 95 million barrels is based on existing facilities and the 159 million barrels is based on future facilities.

In accordance with the policy enunciated in Finding 5 of considering the year by year availability of propane over the

period of the requested permits, the Board has analyzed the manner of meeting the annual requirements of Alberta and the subsisting permit commitment for the years 1966 to 1986 inclusive. In making this analysis the Board considered the seasonal variation in the market demand for propane in Alberta to determine whether special provision should be made for protection of peak day requirements. The Board concludes that having regard for storage facilities and certain flexibilities in propane production and demand that special protection for peak day requirements is not necessary. In addition the Board gave consideration to whether the annual balancing of production and requirements should be made on an area or Province-wide basis. The Board concludes that an area analysis is not warranted since propane is produced in various areas of the Province and marketing facilities service all areas.

The Board estimates that, after providing for the annual Alberta requirements and the subsisting permit commitment, there will be a propane surplus, based on production from existing facilities of some 10,000 barrels per day in 1966 which will increase to approximately 12,000 barrels per day for the years 1967 to 1969 inclusive and thereafter will decline gradually to a balanced position in 1984 and a deficit of some 3,000 barrels per day in 1986. If allowance is made for future processing facilities, the surplus for 1966 and 1967 is unchanged but then increases to some 19,000 barrels per day, declining thereafter to some 4,000 barrels per day by 1986. The Board places greater

weight on the latter figures and is satisfied that the deficiencies indicated in the former will not materialize.

As provided for in the aforementioned policy, the Board has examined the remaining propane reserves as at the end of the requested permit and the total requirements of the Province for the remainder of the thirty-year period, 1987 to 1995 inclusive.

The Board estimates that the reserves of propane remaining in 1986 at the end of the term of the requested permits would be 140 million barrels with existing facilities and 151 million barrels including future facilities. The remaining thirty-year requirements are 88 million barrels, thus indicating a surplus for the remainder of the period of 52 million barrels with existing facilities and 63 million barrels including future facilities.

Details of the evidence and the Board's analysis of these matters appear in Appendix C.

7. IN THE MATTER OF THE QUALIFICATION OF CANADIAN HYDROCARBONS LIMITED AS AN APPLICANT

The Board has given serious consideration to arguments respecting the qualification of Canadian Hydrocarbons Limited as an applicant under section 5, subsection (1) of The Gas Resources Preservation Act, 1956. Interveners at the hearing contended that the letter agreements between Canadian Hydrocarbons Limited and Canadian Superior Oil Ltd. and Shell Canada Limited are not legally effective contracts and consequently Canadian Hydrocarbons is not a qualified applicant. On the other hand Canadian Hydrocarbons argued that the letter agreements are contracts, and

also contended that the propane subject to ownership or contract and the propane for which a permit is sought need not be the same.

The Board cannot accept the latter argument. It expects an applicant under section 5, subsection (1) to show that he owns or has a contract for a substantial part of the propane referred to in his application.

The determination of whether the letter agreements tendered by Canadian Hydrocarbons are effective contracts for the purchase of the propane referred to in the application has given the Board considerable difficulty. The Board appreciates that the wording of the agreements leaves room for argument both for and against their validity, but for the reasons discussed in Section VI, the Board is satisfied as to the effectiveness of the letter agreements and accepts Canadian Hydrocarbons as an applicant qualified under section 5, subsection (1) of the Act.

8. IN THE MATTER OF THE VOLUMES UNDER CONTRACT AND THE PERMIT VOLUME REQUESTED BY CANADIAN HYDROCARBONS LIMITED

The Board recognizes that because of the historic use of short term contracts in marketing propane it may not be reasonable to expect or require applicants wishing to remove propane from the Province to have the full amount applied for covered by contract. On the other hand the Board does not believe it proper to issue a permit in which the annual volumes authorized for removal are either considerably greater over the full term of the permit than the volumes held under contract by the applicant, or

greater than the Board's estimate of production from the fields and processing plants specified in the application.

Where the volumes applied for by the applicant are not fully covered by contract, the Board is prepared to grant a permit authorizing removal during the first two years of maximum volumes exceeding the established contract volumes by two-thirds, and during the later years maximum volumes equal to the established contract volumes for such years plus ten per cent of them to allow for flexibility and some spot purchases. Further, the Board is prepared in such a case to allow the permittee the opportunity of satisfying it, not later than twenty-one months from the commencement of the term of the permit, that it has contracted for additional purchases of propane at the fields or plants named in the permit, and if this should be done, the Board would, upon application and by stipulation increase the maximum annual permit volumes for the third and subsequent years by 110 per cent of the additional volumes contracted for up to a maximum normally equal to the lesser of the first or the second year permit volume. Each annual volume would be subject to the further limitation that it would exceed neither the volume first applied for nor the volume which the Board at the time it issues the permit expects will be recovered at the fields and plants named in the permit.

Applying the above to the Canadian Hydrocarbons application, the Board finds that the volumes that may be removed would be 776,000 barrels for the year commencing in 1966 and 746,000 barrels in 1967. In subsequent years, and should Canadian Hydrocarbons not obtain further contracts, the applicant could

remove volumes which decrease from 407,000 barrels commencing in 1968 to 293,000 barrels in 1973 and then remain constant for the balance of the term of the permit. In accordance with the above recited rules, the volumes in these subsequent years would be subject to increase by stipulation by the Board upon receipt of a satisfactory application within twenty-one months after the commencement of the term of the permit.

For the purpose of assessing whether or not a surplus of propane would exist should the two applications for removal be granted, and in order to assure adequate protection for Alberta requirements and permit commitments, the Board has assumed that additional contracts would be executed by Canadian Hydrocarbons, and that the volumes of the second year would continue to be removed to the extent permitted by field and plant capacity during the remaining years of the permit. Should similar calculations be made after October 31, 1968, the Board will consider the permit commitment to be the actual volumes in the permit or in a stipulation to the permit.

This aspect of the application is discussed in Section VI.

9. IN THE MATTER OF THE APPLICANTS' REQUESTS FOR AUTHORIZATION FOR THE REMOVAL OF PROPANE AND THE SURPLUS WHICH WOULD RESULT IF THE REQUESTS WERE APPROVED

The Board finds that, if the volumes that the Board is prepared to authorize for the Canadian Hydrocarbons application and the British American application were granted, the reserves of propane surplus to the requirements of the Province and the

permit commitments would be reduced to 76 million barrels based on existing facilities and 140 million barrels based on future facilities.

The Board finds that after providing for the annual Alberta requirements, the subsisting permit commitment and the application as modified, the year by year surplus of propane, based on production from existing facilities and from a two year growth of gas reserves, would be some 8,000 barrels per day for the period 1966 to 1969 inclusive and thereafter would decline to a balanced position in 1983 and a deficit of some 5,000 barrels per day in 1986. If allowance is made for future processing facilities, the surplus for 1966 and 1967 is unchanged but then increases to some 15,000 barrels per day, declining thereafter to 2,500 barrels per day by 1986. As in the case of Finding 6, the Board places greater weight on these latter figures and is satisfied that the deficiency indicated by the former figures would not materialize.

Should both applications be granted the reserves remaining in 1986 at the end of the term of the requested permits, and the surplus over the remaining thirty-year Alberta requirements and subsisting permit commitment, would be unchanged from the 140 and the 151 million barrels and from the 52 and the 63 million barrels respectively referred to in Finding 6.

The Board concludes that Alberta requirements and the subsisting permit commitment would be fully protected should the Canadian Hydrocarbon application, in the volumes that the Board

is prepared to authorize, and the British American application be granted.

Details of the Board's analysis relating to these matters are presented in Appendix D.

10. IN THE MATTER OF THE DISPOSITION OF THE APPLICATION OF CANADIAN HYDROCARBONS LIMITED

All things considered, the Board is prepared, with the approval of the Lieutenant Governor in Council, to refuse to issue an approval for the full amount of the volumes of propane applied for by Canadian Hydrocarbons Limited but is prepared, with the approval of the Lieutenant Governor in Council, to issue a permit to Canadian Hydrocarbons Limited authorizing it to remove from the Province a lesser amount than applied for, the permit to be in the form shown in Appendix E, and for the volumes and subject to the terms and conditions therein contained.

11. IN THE MATTER OF THE DISPOSITION OF THE APPLICATION OF THE BRITISH AMERICAN OIL COMPANY LIMITED

All things considered, the Board is prepared, with the approval of the Lieutenant Governor in Council, to issue a permit to The British American Oil Company Limited authorizing it to remove from the Province 730,000 barrels of propane annually for a period of ten years, the permit to be in the form shown in Appendix F and subject to the terms and conditions therin contained.

Respectfully submitted,

G. W. Govier, P.Eng.,
Chairman.

A. F. Manyluk, P. Eng.,
Deputy Chairman.

Vernon Millard,
Board Member.

Dated at Calgary, Alberta,
this 10th day of September, 1965.

APPENDIX A

THE PRESENT AND FUTURE PRODUCTION AND THE RESERVES OF PROPANE IN THE PROVINCE OF ALBERTA

Introduction

The Board is concerned with the ability of the propane reserves from established gas reserves to satisfy the Province's thirty-year requirements in total, and also with the annual availability of propane over the period of the requested permits. For this reason, the Board has included in this Appendix a detailed estimate of the recoverable reserves of propane in the Province and has also made a forecast of propane production from established reserves by years for the term of the requested permits, 1966 to 1986 inclusive. Since the computation of reserves depends to a degree on the production forecast, the forecast is presented first. In estimating both the reserves and production, the Board has concerned itself only with field propane and has excluded propane produced at refineries and propane produced in conjunction with self-sustaining miscible flood projects.

The Board agrees with the views advanced by Canadian Hydrocarbons and British American at the hearings that a certain amount of propane production from the gas reserves not yet developed will take place during the period of the forecast. As to the amount of future growth in gas reserves which should be considered, the Board believes that the policy with respect to protecting the future propane requirements of the Province should be consistent with the policy respecting gas. For this reason, the Board has decided to include the propane production associated with two years growth of gas reserves when considering the

problem of meeting Alberta's long term requirements for propane. The Board has included in this appendix a forecast of the manner in which the two years growth of gas reserves and the associated propane will be produced.

Future Production of Propane

1. Production of Propane from Established Gas Reserves

During the hearing of the Canadian Hydrocarbons application, evidence as to the expected propane production from established gas reserves for the period 1964 to 1996 inclusive, was presented on behalf of the applicant by R. R. McDaniel of the consulting firm of McDaniel Consultants Ltd. In preparing his forecast, Mr. McDaniel used the Board's estimate of gas reserves as of December 31, 1963, adjusted for production to the end of 1964.

In the McDaniel submission, propane production from established gas reserves is expected to increase from a 1964 production rate of some 18,000 barrels per day to about 23,000 barrels per day by 1970 and to remain at that level until about 1980. The production is then expected to increase steadily to a level of about 27,000 barrels per day by 1996.

In brief, the forecast submitted by Mr. McDaniel was prepared in the following manner:

1. The total provincial disposable gas production was estimated for the future thirty-year period. The gas production necessary to meet Alberta's requirements was taken from the OGCB Report 64-1.[1] The gas production

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(1) Report on an application of Trans-Canada Pipe Lines Limited under The Gas Resources Preservation Act, 1956. February, 1964.

to meet the existing commitments for removal from the Province was based on existing permits but was continued beyond the expiry date of the permits at a constant level for the entire period of the forecast. (The permits expire over the period 1976 to 1989).

2. The anticipated propane production associated with the total provincial gas production was estimated assuming a recovery ratio of 7.7 million barrels of propane per trillion cubic feet of gas. This ratio is Mr. McDaniel's interpretation of the 1964 ratio of the total recoverable propane reserves to the total disposable gas reserves for the Province.

3. The additional propane production expected to result from the installation of deep-cut recovery facilities at the Harmattan area and the Carstairs plants was estimated and added to the propane expected from normal gas production and processing.

Since the proposed Canadian Hydrocarbons facilities would be carrying natural gas liquids other than propane, Mr. McDaniel also presented a prediction of butanes and pentanes plus supply for the Province over the next thirty years. In this report, the Board is concerned only with the application for authority to remove propane from the Province and for this reason has not discussed the detail of the forecast where it deals with butanes and pentanes plus.

Mr. A. Janisch, Mr. J. Beddome and Mr. R. van der Velde, on

behalf of British American at the hearing of its application, presented a forecast of anticipated propane production for the Province covering the period 1965 to 1976 inclusive. The British American forecast indicated that propane production will increase from the 1964 level of about 18,000 barrels per day to some 23,000 barrels per day during 1965 and will continue to increase to some 41,000 barrels per day by 1969. The propane production as predicted by British American will remain at about this rate until 1976, the last year of the forecast.

The forecast submitted by British American was prepared generally in the following manner:

1. The propane supply from oil and gas fields now producing or under gas purchase contract with existing or proposed propane recovery facilities was estimated on an individual plant basis.
2. Future gas production from reserves currently shut in or from reserves not yet developed that will be necessary to satisfy the Provincial requirements plus authorized removals from the Province was estimated. This was done by subtracting the gas available from contracted fields from the total demand for Alberta gas.
3. The propane supply associated with the expected gas production from reserves not currently producing was estimated assuming a recovery ratio of ten barrels of propane per million cubic feet of residue gas. This ratio is British American's interpretation of the

present average propane recovery ratio for all producing fields..

4. The gas volumes to be moved through the Foothills Division of the Alberta Gas Trunk Line system were estimated on the basis of existing permits for the removal of gas from the Province.

5. The propane that could be recovered from the reprocessing of the residue gas in the Foothills Division of Trunk Line was estimated by applying a recovery ratio of 9.6 barrels of propane per million cubic feet of residue gas. This ratio was determined from analyses of gas samples taken from the total gas stream as it is today at the British Columbia border and by applying a recovery factor of some 85 per cent.

6. The total propane production expected from the Province was estimated as the sum of the quantities determined by the above steps 1, 3 and 5.

With respect to step 2 above, the projection actually includes some propane production from gas reserves not yet developed, in that British American did not separate the gas production necessary to satisfy future provincial requirements into a component from established reserves currently shut in and a component from reserves not yet developed.

The Board has prepared its own forecast of propane production from established gas reserves. Throughout the preparation of this forecast the Board has given consideration to the evidence

submitted by or on behalf of Canadian Hydrocarbons and British American at the hearings.

The propane recovered in the Province during 1964 amounted to some 45 per cent of the propane contained in the total gas produced. The Board believes that the recovery of propane in the future could be as high as 75 per cent on a Province-wide basis and that the actual production will depend almost entirely upon the demand for propane. It is logical that as the demand increases, additional quantities of propane up to some maximum, will become available. For this reason, the Board believes that an analysis of the future supply of propane must include the additional production that could result from future processing facilities as well as the expected production from existing facilities. The resulting projection of total production may be considered an availability forecast rather than a prediction of actual supply.

Table A-1 presents the Board's forecast of propane production from established gas reserves for the period 1966 to 1986, based on existing propane recovery facilities including all processing facilities approved by the Board up to June 30, 1965. The table includes the expected production of propane from field facilities and from those constructed for the reprocessing of pipe line gas.

Table A-2 presents the Board's forecast of additional propane production expected from future processing facilities. The first part of the table presents a projection of the additional propane production which could result from the reprocessing of pipe line gas. This estimate reflects production

from an anticipated processing plant on the Foothills Division of Alberta Gas Trunk Line beginning in 1968, and also from facilities to reprocess a small portion (ten per cent of the total production beginning in 1970 and increasing to twenty per cent in 1975) of the gas necessary to meet Alberta's future requirements in addition to that being processed at the Edmonton Liquid Gas Plant.

The table also includes an estimated increase in propane production that could result from a higher recovery at plants already producing. These increased recoveries would be made possible by changes in plant design to result in the recovery of a higher percentage of the propane. Also included in the table are production estimates for those fields where propane is not currently being recovered but where the Board expects propane production would occur under more favourable marketing conditions. The recovery factors for these fields reflect the installation of deep-cut recovery facilities. Propane production from both of these sources is expected to begin in 1968.

The propane production from the reprocessing of pipe line gas was estimated in the light of the currently existing field facilities for the recovery of propane. If the additional facilities reflected in the second portion of the table (based on the installation of new facilities in some instances or deep-cut facilities in others) are installed, this will result in a reduction in propane recovery from both existing and possible future pipe line reprocessing plants. For this reason, a third portion of the table has been prepared to reflect the

reduction in propane production from reprocessing plants that would result with the installation of the additional field facilities.

The final portion of the table shows the total propane production expected from the Province. (Table A-1 plus Table A-2).

Tables A-1 and A-2 in total, reflect the expected gas production from all established reserves including one-half of those reserves currently considered beyond economic reach. This gas production will be sufficient to meet all of the existing commitments for the removal of gas from the Province and the future provincial thirty-year gas requirements except for that portion expected to be satisfied from two years growth of gas reserves. The propane production associated with this gas will be discussed later in the appendix.

The following is a brief summary of the manner in which the forecasts in Tables A-1 and A-2 have been prepared:

1. The gas producing rates for each field or area were taken from the latest deliverability schedules available to the Board. Where the gas was being delivered to an extraprovincial market, production was considered for only the term of the applicable permit. Where schedules were not available or were outdated, the rate of gas production which was used is one million cubic feet per day for each ten billion cubic feet of reserves. In areas where the

plant feed will be oilfield separator gas, the producing rate was forecast on the basis of the expected oil allowables and gas-oil ratio behaviour for the pools involved. Where fields were not yet producing gas, the date of initial production was estimated having regard for the future provincial requirements for gas and for the Board's knowledge of plans for pipe line construction in the Province. In keeping with the Board's policy with respect to satisfying the future thirty-year requirements of the Province for gas, production was estimated for a portion of those reserves currently considered beyond economic reach. On the basis of the study referred to in OGCB Report 64-11[2] the Board estimated that one-half of the reserves now considered beyond economic reach will be supplying a market within thirty years. The individual fields to be produced were selected bearing in mind the magnitude of each reserve, its location, the nearness of pipe lines, and the expected development in drilling and in transportation facilities.

2. The composition of gas produced from each pool was based on a representative analysis.

3. Changes in the composition of the gas being produced from any particular pool were based on reservoir fluid

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(2) Report on the applications of Trans-Canada Pipe Lines Limited and Alberta and Southern Gas Co. Ltd. under The Gas Resources Preservation Act, 1956. November, 1964.

studies wherever possible. In areas where retrograde effects were anticipated but fluid studies not available, changes in propane content were estimated by comparison to similar reservoirs for which studies were available. Where gas cycling schemes to curtail retrograde losses were in operation or expected in the future, the production forecast reflects the Board's estimate of how the propane recovery will be affected by cycling.

4. Plant recovery efficiencies were based on plant history wherever fields had been producing for a reasonable length of time. In several areas, plants were in the planning or construction stage or had been operating for only a short time, and in these instances, recoveries were based on submissions presented to the Board in support of applications under section 38 of The Oil and Gas Conservation Act or on the Board's general knowledge of plans for future plants in the Province. For those areas listed in Table A-2 where the Board had no information regarding the proposed plant design or where future and as yet undesigned deep-cut recovery facilities were expected, the recovery efficiencies were estimated having regard to expected economic conditions, the quantity and composition of the gas to be produced, and the residue gas pipe line

calorific and dew point standards. In general, the production expected from propane plants to be built or modified in the future reflects recoveries of from 60 to 75 per cent of the propane contained in the raw gas stream.

5. The gas throughput and composition for plants reprocessing pipe line gas were based on the predicted amount and composition of the residue gas available from the fields or areas supplying or expected to supply such plants. The propane recovery efficiencies were based on plant design for existing plants, and were estimated at eighty per cent for future plants.

The Board's forecast of propane production from established reserves and existing facilities as presented in Table A-1 shows an increase from the 1964 production rate of some 18,000 barrels per day to a peak of about 32,000 barrels per day in 1968. The production is then expected to remain approximately level until 1976 and to decline slowly to about 18,000 barrels per day by the end of the forecast period. The expected increase over the next five years is largely the result of additional quantities of gas being processed at many of the plants. The decline in the later years is the result of a general decline in gas producing rates resulting from the gradual depletion of the pools currently producing and from the expiry of certain permits to remove gas from the Province.

Table A-2 shows that, if market conditions are attractive, an additional 6,000 to 8,000 barrels per day of propane will be produced beginning in 1968. This additional production may be recovered at field plants or at central facilities for the reprocessing of pipe line gas. The table also shows that the total propane production from established reserves will increase from the 1964 production rate of some 18,000 barrels per day to some 39,000 barrels per day in 1968, will then remain approximately level until 1979, and thereafter decline steadily.

Table A-3 has been prepared to compare the Board's forecast of propane production from established gas reserves to the applicants' forecasts discussed earlier in this appendix. The Board's forecast was taken from Tables A-1 and A-2 and the estimated production rounded to the nearest 100 barrels per day. Included in the table are the Board's and each of the applicants propane production estimates for the years 1966 to 1986 inclusive.

The table shows that for the next fifteen or so years the Board's forecast from existing plant facilities is considerably higher than the forecast presented on behalf of Canadian Hydrocarbons even though it too has been based primarily on existing plant facilities. This is because the Canadian Hydrocarbons study was completed early in 1964, and the forecast production has been based on the provincial propane reserve to gas reserve ratio at that time. During the period since completion of the study, new facilities have resulted in an increase of almost fifty per cent in this ratio. For the later years, the Canadian

Hydrocarbons forecast is higher than the Board's. This is because the Board forecast reflects a significant decline in gas deliverability from several fields included in permits for the removal of gas from the Province while the Canadian Hydrocarbons forecast assumes that removals will continue at a constant rate.

The Board's forecast of propane production from established gas reserves including future plant facilities is slightly lower than the British American forecast. The main reason for this is that the British American forecast includes some propane production from gas reserves not yet developed.

Canadian Hydrocarbons proposed the removal from the Province of propane produced at the Harmattan area plant, and at the hearing of its application Mr. McDaniel presented a forecast of production from this plant for the period 1965 to 1984 inclusive. This forecast indicates that the total production from the plant will increase from less than 1,000 barrels per day during 1965 and 1966 to some 3,700 barrels per day for the years 1967 to 1969 inclusive. Production will then decline gradually to some 1,900 barrels per day by 1984. Mr. McDaniel stated at the hearing that his production estimates for the Harmattan area plant were based on preliminary data and "there may be some variation on those figures as to the actual efficiency of that system".

Canadian Hydrocarbons also presented at the hearing, letter agreements between itself and Canadian Superior and Shell with respect to propane to be purchased from the Harmattan area plant.

The letter agreements included an estimate of the propane production expected from the plant over the period 1965 to 1984 inclusive. The production as estimated in the letters is expected to increase from less than 1,000 barrels per day in 1965 to some 2,900 barrels per day in 1966 and to decline thereafter to less than 1,500 barrels per day by 1974. The production is then estimated to remain level for the remainder of the period.

The Board has completed its own estimate of the propane production expected from the Harmattan area plant. The forecast was based primarily on detailed cycling studies submitted to the Board by the operators of both the Harmattan-Elkton and Harmattan East fields and on the performance of the cycling schemes to date. On the basis of the studies the Board is of the opinion that the McDaniel forecast has not given sufficient recognition to the amount of dry gas that will break through and be produced during the cycling of each of the reservoirs and that, as a result, the projected propane production is too high. The Board forecast compares very closely with the estimates contained in the letter agreements and as a result, the Board has accepted these estimates in preparing its own forecast.

British American at the hearing of its application estimated that the production of propane at the Rimbey, Nevis and Pincher Creek plants, from which it intends to remove propane from the Province, would be greatly in excess of the

2,000 barrels per day applied for. The Board concurs generally with the British American estimates of propane production from each of these plants over the period of the requested permit, 1966 to 1975, and agrees that the total production from these plants will be much greater than the quantities requested.

2. Production of Propane from Gas Reserves Not Yet Discovered

Mr. McDaniel in his submission on behalf of Canadian Hydrocarbons presented a propane supply and demand balance for the Province for a thirty-year period. The balance was based on the projected demand for propane for the Province including permit commitments as estimated by Dr. Sievwright and discussed in a later appendix, the requirements for removal of propane from the Province as requested by Canadian Hydrocarbons, and the projected supply of propane from established reserves as estimated by Mr. McDaniel and discussed earlier in this appendix. The balance shows that a propane deficiency of some 450 barrels per day would occur in 1968 and that the deficiency would increase to over 6,000 barrels per day by 1986, the last year of the period over which Canadian Hydrocarbons proposed to remove propane. The deficiency will then drop to less than 5,000 barrels per day and increase rapidly to about 10,000 barrels per day by 1996. Mr. McDaniel then estimated the additional gas reserves that would have to be developed and processed to eliminate this projected deficiency for propane. The estimate was made on the basis that the additional gas

reserves would be produced at a rate of one million cubic feet per day for each ten billion cubic feet of available reserves, and that the recoverable propane associated with these reserves would be 7.7 barrels per million cubic feet of residue gas (Mr. McDaniel's interpretation of the 1964 ratio of recoverable reserves of propane to remaining disposable reserves of gas). The total additional gas reserves that would be required over the next thirty years to eliminate the deficiency projected by Mr. McDaniel would amount to some 12.8 trillion cubic feet. This is the equivalent of about five years of future gas at the Board's long term growth rate of 2.5 trillion cubic feet per year. Mr. McDaniel then pointed out that a portion of the supply deficiency could be satisfied by the installation of deep-cut recovery facilities at existing plants and that this would decrease the additional natural gas reserves which would have to be developed and processed in order to meet the total demand for Alberta propane. Although the submission did not include an estimate as to what portion of the deficiency might logically be satisfied from these other sources, Mr. McDaniel stated in reply to a question at the hearing that he believes the additional gas reserves required would be less than the two years growth of gas reserves that the Board normally gives weight to when considering applications for the removal of gas from the Province.

British American included in its submission a propane supply and demand balance for the Province for the period, 1965 to 1976 inclusive. One component of the total projected supply was

the propane production expected from currently shut-in sources or future discoveries. In British American's submission, production of propane from these sources will begin in 1967 at some 700 barrels per day and increase to some 4,900 barrels per day by 1976, the final year of its forecast. These estimates were made generally in the following manner:

1. The total demand for Alberta gas was tabulated for the period 1965 to 1976 on the basis of the Board's estimate of Alberta's requirements as shown in OGCB Report 64-11[3] and the existing commitments for the removal of gas from the Province.
2. The gas supply available from fields now on stream or under contract was estimated on the basis of the latest available deliverability schedules.
3. The gas supply required from currently shut-in sources or future discoveries was determined by years as the difference between items 1 and 2.
4. The propane associated with the expected gas production from currently shut-in sources or future discoveries was estimated by applying a propane recovery ratio of ten barrels per million cubic feet of gas produced. This was based on the British American estimate that the current recoverable propane reserve to gas reserve ratio for fields now producing or under contract is some 11.1 barrels per million cubic feet of residue gas.

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(3) Report on the applications of Trans-Canada Pipe Lines Limited and Alberta and Southern Gas Co. Ltd. under The Gas Resources Preservation Act, 1956. November, 1964.

British American in its submission did not attempt to estimate separately that portion of this additional propane production which could be expected from gas to be developed in the future. In reply to a question at the hearing, Mr. Janisch stated that in his opinion such a breakdown would be practically impossible.

The Board has prepared an estimate of the propane recoverable from two years growth of gas reserves and also has forecast the availability of this propane by years. As in the case of propane from established reserves the production forecast is presented first.

In general terms, in preparing an estimate of the future propane production from gas reserves not yet discovered, it is necessary to

(a) project the growth rate for natural gas reserves,

(b) project the annual pattern by which these reserves will be produced, and

(c) estimate the recoveries of propane from the future gas.

The Board's OGCB Report 65-8[4], includes a detailed analysis of the trends in the growth and discovery of gas reserves as of December 31, 1964. The trends have not been re-analyzed at this time but data and conclusions from the reserve report have been used in the preparation of this report. The December 31, 1964, study shows that the long term growth in gas reserves has remained unchanged at some 2.5 trillion cubic feet per year. However, it

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(4) Reserves of Gas, Natural Gas Liquids, Crude Oil and Sulphur Province of Alberta. December 31, 1964.

also shows that the actual reserve growth over the two-year period prior to the report (January 1, 1963 to December 31, 1964) was some 4.3 trillion cubic feet. Therefore, in keeping with Board policy of using the lesser of the actual growth in reserves over the two previous years or two years of growth at the long term growth rate, it was decided to rely on the propane expected from 4.3 trillion cubic feet of gas reserves not yet developed in satisfying Alberta's long term requirements for propane.

In order to project the annual pattern by which these new gas reserves will be produced, the Board has attempted to estimate what amount of future reserves will be required to help meet Alberta's thirty-year requirements for gas. A comparison of the available supply to the existing requirements indicates that approximately 4.3 trillion cubic feet of gas reserves not yet developed will be needed to satisfy the Province's requirements. If the expected growth over a two-year period is relied upon, no surplus for extraprovincial markets results, and the only production from this future gas will be to satisfy the Province's future requirements. On the basis of detailed deliverability schedules, the Board estimates that production from this gas will begin at low rates about 1970 and will build up to a maximum of about 130 billion cubic feet per year by the end of the forecast period. The expected gas production from reserves not yet developed is shown in column 2 of Table A-4.

To estimate the recoverable propane associated with future growth in gas reserves, the Board has carried out a detailed

investigation of all available evidence on this matter. The main factors considered by the Board were

(a) the average propane content of the established gas reserves,

(b) the manner in which the propane content is increasing or decreasing with new discoveries, and

(c) the average propane recovery ratio for current gas production.

As a result of a detailed study of the propane content of established gas reserves, the Board has concluded that on the average the gas contains about twenty barrels of propane per million cubic feet, and that the propane content has remained approximately level over the past ten years. On the basis of this study the Board has estimated that the propane content of the 4.3 trillion cubic feet of gas (two years growth) will be twenty barrels per million cubic feet. The resulting wellhead production of propane is shown in column 3 of Table A-4.

During 1964, about 45 per cent of the propane in the composite gas stream produced in the Province was recovered as a commercial product. If the additional recovery facilities projected in Table A-2 are installed, the average propane recovery will increase to some 75 per cent. However, the Board believes that, because many of the reserves serving only provincial requirements are small, contain less propane and would be produced at a lower load factor than the reserves serving extraprovincial markets, the recovery of propane from such reserves will be less than the average recovery for the entire Province. For this reason the Board has concluded

that fifty per cent of the propane in the gas reserves not yet developed will be recovered. The resulting propane production expected from this gas is shown as column 4 of Table A-4. The table shows that propane production from reserves not yet developed will begin in 1970 at very low rates and will increase steadily to some 3,500 barrels per day by 1986.

Table A-5 presents a comparison of the total future propane production estimated by the Board with that estimated in each of the submissions made to the Board at the hearings. The Board estimates have been taken from Tables A-1, A-2 and A-4 and have been rounded to the nearest 100 barrels per day. The Board forecast from existing plant facilities and two years growth of gas reserves is much higher than the Canadian Hydrocarbons forecast for the early years but is lower in the later years. The difference in the early years is because the Canadian Hydrocarbons forecast was based on the propane reserve to gas reserve ratio which existed in 1964 and which is significantly lower than the current ratio. The Canadian Hydrocarbons forecast is higher than the Board's in the later years because it assumes that gas removals from the Province will continue beyond the expiry date of the permits, and also because it incorporates either additional deep-cut recovery facilities or more than two years growth of gas reserves in the later years. The Board forecast including future plant facilities and two years growth of gas reserves agrees closely with the British American forecast.

Reserves of Propane

Mr. McDaniel, in his submission on behalf of Canadian Hydrocarbons, estimated the reserves of propane associated with established gas reserves in fields where propane recovery facilities are in existence or where it is understood that propane will be recovered in the future, to be some 275 million barrels. He stated at the hearing that these reserves reflect propane recovery factors consistent with 1964 recoveries, and that if the facilities were modified where necessary to reflect a deep-cut recovery, the propane reserves would be increased by some 32 million barrels to a total of 307 million barrels.

Mr. McDaniel estimated that an additional 49 million barrels of propane reserves exist in "probable fields". He defined as probable fields, those reserves where plants capable of propane recovery do not exist and which are delivering or will deliver gas to pipe line systems other than Trans-Canada Pipe Lines. Mr. McDaniel stated that the estimate of 49 million barrels of probable reserves reflects the recovery of propane at normal recovery factors, and if deep-cut recovery facilities should be installed, an additional 34 million barrels of propane reserves would be available, for a total recoverable propane reserve of some 390 million barrels.

Mr. McDaniel also estimated that a possible additional propane reserve of about 316 million barrels might be expected from gas reserves not yet developed. When questioned at the hearing, he stated that the propane reserves associated with the gas to be developed over a two-year period amounted to some 28 million

barrels under 1964 recovery conditions or some 48 million barrels under conditions of deep-cut recovery. Added to the 390 million barrels estimated by Mr. McDaniel to be recoverable from established gas reserves, this results in a total recoverable propane reserve of some 438 million barrels.

The above mentioned reserve estimates were prepared generally in the following manner:

1 The reserves for fields where propane recovery facilities exist or are expected in the future, were estimated on an individual field basis. The gas composition for each pool was based on a representative analysis. Where facilities exist, the recovery factor was based on plant design and history. Where facilities are expected in the future, the propane recovery was estimated at fifty per cent.

2 The probable reserves include only those fields which contain significant reserves of propane and were estimated on an individual field basis. The gas composition for each pool was based on a representative analysis and the propane recovery was estimated at fifty per cent.

3 The additional possible propane reserve was based on an estimated ultimate gas reserve of eighty trillion cubic feet and a future average recoverable propane ratio of 7.7 barrels per million cubic feet of gas. The propane associated with two years growth of gas

reserves reflects a growth rate for gas of 1.8 trillion cubic feet per year and a recoverable propane ratio of 7.7 barrels per million cubic feet increasing to 13.1 barrels per million cubic feet under deep-cut recovery conditions.

British American, in its submission estimated the total available reserves of propane in the Province to be some 449 million barrels. This propane reserve was estimated as follows:

1 Propane reserves from fields on stream or under gas purchase contracts with existing or proposed propane recovery facilities were estimated at some 305 million barrels. This reserve represents a summation of individual plant estimates which were based on propane yields experienced to date or on design data for proposed facilities.

2 Propane reserves potentially available from fields that are delivering or will deliver gas to the Foothills Division of the Alberta Gas Trunk Line system were estimated at about fifty million barrels. This estimate was obtained by applying a propane recovery factor based on the composite stream analysis to the gas reserves supplying the system.

3 Propane reserves potentially available from fields currently shut in and not under gas purchase contracts were estimated at some 94 million barrels. This estimate was obtained by applying to these gas reserves,

a propane recovery factor based on the average propane yield for all gas contracted for or on stream.

In addition, British American estimated that some 278 million barrels of propane would be available from gas reserves to be developed over a ten-year period. This estimate was made by accepting the Board's long term growth rate for gas of 2.5 trillion cubic feet per year, and applying a propane recovery ratio based on the average propane yield from gas fields currently on stream. Accepting British American's recovery ratio, the reserves associated with two years growth of gas reserves amounts to some 55 million barrels. This brings the total reserves to 504 million barrels.

The Board has completed its own estimate of the established propane reserves as of December 31, 1964, and the propane associated with two years growth of gas reserves. Since the reserves of propane should include only those reserves economically recoverable, it follows that a study of the reserves need be concerned only with the fields or areas listed in Table A-1 and A-2. Table A-6 represents the recoverable reserves of propane as estimated by the Board. Part A of the table deals with those fields or areas where propane is now being recovered. Part B lists those fields or areas where propane is considered to be economically recoverable in the future. The table has been prepared by averaging the recovery ratios for each field in the forecast over the life of the pool, and by multiplying the resulting average ratio by the remaining gas reserves for

the field. Column 1 of the table sets out the location of the reserves either by field, by area or, where the composite of more than one field exists, by plant name. Column 2 indicates the producing zone or zones. Column 3 is the total remaining marketable gas reserve for the pools designated in columns 1 and 2. These reserves hae been taken from Table I-1 of the Board's OGCB Report 65-8(5). Column 4 is a tabulation of the average propane recovery factor as determined over the life of each pool from Tables A-1 and A-2. Column 5 is the product of the columns 3 and 4 and is the recoverable propane reserve for each field, area or plant.

The table shows in addition to those reserves recoverable from field processing plants, propane reserves that may result from the reprocessing of pipe line gas both at existing and future facilities. Since these estimates have been based on the residue gas available from existing field facilities, the installation of the future facilities reflected in the second portion of the table would result in a reduction in reserves available from this source. For this reason, Part C of the table has been included to adjust downwards the reserves available from the reprocessing of pipe line gas and to make them consistent with the reserves shown for field recovery facilities.

Table A-6 shows that the recoverable propane reserves based on existing facilities are estimated by the Board at some 325 million barrels. The table also shows that if sufficient demand

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(5) Reserves of Gas, Natural Gas Liquids, Crude Oil and Sulphur Province of Alberta. December 31, 1964.

for the product should materialize, an additional 64 million barrels of propane can be considered as recoverable increasing the total available reserves to some 389 million barrels.

It has been mentioned earlier in this appendix that the Board estimates the propane content of the 4.3 trillion cubic feet of gas (two years growth) at some twenty barrels per million cubic feet and that fifty per cent of this propane will be recoverable. This results in a propane reserve from future gas of some 43 million barrels increasing the total reserves to 432 million barrels.

Table A-7 has been prepared to compare the Board's estimate of propane reserves to those of each of the applicants. The table includes the comparable estimates from established gas reserves, from two years growth of gas reserves and the total propane reserves.

The table shows that the Board's estimate of propane from established gas reserves is virtually identical to the estimate made on behalf of Canadian Hydrocarbons but is lower than the estimate made by British American. The main reason for this is that British American used the average propane recovery ratio for those gas reserves now on stream in estimating propane reserves from gas not currently being produced. The Board estimate involved a study of gas fields not currently producing on an individual basis and reflects a lower propane recovery ratio for the total of these reserves because a sizeable portion of them are located in small fields where propane recovery does

not appear economically feasible.

The table also shows that the Board's estimate of propane reserves associated with two years growth of gas reserves is lower than those of each of the applicants. This results primarily because the applicants have both used higher propane recovery ratios than the Board. In the case of Canadian Hydrocarbons, the difference has been partially offset by use of a lower growth rate for gas. On the other hand, British American has used a growth rate higher than the Board's, increasing the difference in the reserve estimate.

FORECAST OF PROPANE PRODUCTION FROM ESTABLISHED GAS

RESERVES BASED ON EXISTING[1] PLANT FACILITIES (BARRELS PER DAY)

PLANT	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
ACHESON	230	250	280	290	240	290	290	290	300	300	300	290	290	290	280	270	260	230	180	160	130
BONNIE GLEN[2]	690	700	710	740	760	770	780	780	790	780	780	770	760	750	750	740	730	720	710	700	690
CARSON CREEK[3]		2180	1850	1720	1640	1570	1500	1470	1450	1410	1340	1300	1250	1220	470	470	480	480	480	480	560
CROSSFIELD	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	970	930	(10)		
HARMATTAN[4]	2880	2750	2660	2150	1910	1770	1750	1610	1480	1480	1480	1480	1480	1480	1480	1480	1480	1480	1480	1480	1480
HUSSAR	560	590	630	630	630	630	630	630	630	630	630	630	630	630	630	580	450	370	(11)		
JUDY CREEK[5]	2420	2510	3050	3310	3520	3550	3580	3620	3660	3690	3710	3710	3710	3710	3710	3710	3710	3710	3710	3710	3710
LEDUC-WOODBEND[6]	680	700	700	700	570	400	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
NEVIS[7]	230	240	250	250	250	250	250	250	250	250	250	250	250	250	260	260	240	250	250	250	240
PEMBINA[8]	2760	2830	2440	2500	2550	2640	2580	2540	2520	2500	2390	2280	2190	2100	2080	2000	1920 (11)	1850	1780	1710	1670
PINCHER CREEK	340	340	340	330	330	320	320	320	310	310	310	280	250	220	190	140					
REDWATER	300	340	350	360	370	370	380	380	380	380	390	380	400	400	400	400	400	390	380	310	250
RIMBEY[9]	5230	5580	5800	5800	5700	5700	5700	5700	5700	5700	5700	5720	5730	5750	5890	4790	2930	1880	1630	1250	660
TURNER VALLEY	430	430	430	430	430	430	430	430	430	410	360	270	250	210	200	170	160	150	140	130	120
WAYNE-ROSEDALE	40	40	50	50	50	50	50	50	50	50	50	50	50	40	40	40	40	40	40	40	20
WILLESDEN GREEN	270	230	210	200	200	200	200	180	180	180	170	170	160	140	120	120 (11)	120	120	120	120	120
WORSLEY	230	230	230	230	230	230	230	230	210	200	180	160	150	100	70						
SUB-TOTAL	18260	20910	20950	20660	20400	20140	20690	20500	20360	20290	20060	19760	19570	19310	18590	17190	14960	13650	11950	11390	10700
EDMONTON LIQUID GAS	1000	1000	1200	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1250	1200	1150	1100	1050	1000	950	900
EMPRESS	8900	9500	10200	10200	10200	10200	10200	10200	10200	10200	10200	10200	10200	10200	10200	9600	8900	8200	7500	6800	6000
TOTAL	28160	31410	32350	32160	31900	31640	32190	32000	31860	31790	31560	31260	31070	30760	29990	27940	24960	22900	20450	19140	17600

(1) INCLUDES FACILITIES APPROVED BY THE BOARD UP TO JUNE 30, 1965.

(2) INCLUDES BONNIE GLEN, GLEN PARK AND WIZARD LAKE FIELDS.

(3) INCLUDES CARSON CREEK AND CARSON CREEK NORTH FIELDS.

(4) INCLUDES HARMATTAN-ELKTON AND HARMATTAN EAST FIELDS.

(5) INCLUDES SWAN HILLS, SWAN HILLS SOUTH, JUDY CREEK AND VIRGINIA HILLS FIELDS.

(6) INCLUDES LEDUC-WOODBEND AND GOLDEN SPIKE FIELDS.

(7) INCLUDES NEVIS, STETTLER, FENN-BIG VALLEY AND HACKETT FIELDS.

(8) PROPANE RECOVERED AT TWO PLANTS.

(9) INCLUDES HOMEGLEN-RIMBEY AND WESTEROSE SOUTH FIELDS.

(10) PERMIT EXPIRES.

(11) GAS RESERVES DEPLETED.

TABLE A-2

FORECAST OF ADDITIONAL PROPANE PRODUCTION FROM

ESTABLISHED GAS RESERVES AND FUTURE PLANT FACILITIES (BARRELS PER DAY)

Plant, Field or Area	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Plant on Foothills Division of Alberta Gas Trunk Line			5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	4600
Other plants for reprocessing of pipe line gas					400	400	400	450	450	900	900	900	950	950	950	1000	1000	1000	1000	1000	1000
Sub-total			5000	5000	5400	5400	5400	5450	5450	5900	5900	5900	5950	5950	5950	6000	6000	6000	6000	6000	5600
Increased Production[1]			1650	1650	1700	1700	1700	1700	1700	1700	1650	1600	1600	1550	1550	1550	1500	1500	1450	1400	1400
Carstairs[2]			980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980	980
Gilby			1290	1290	1290	1290	1290	1290	1290	1290	1290	1290	1290	1270	1140	1030	930	840	760	700	640
Lookout Butte						300	420	420	420	420	420	420	420	420	420	420	420	420	420	420	420
Medicine River			330	330	330	330	330	330	330	330	330	330	330	330	340	340	340	340	340	340	340
Minnehik-Buck Lake			640	640	610	610	610	610	610	610	610	610	620	620	630	630	630	580	490	420	370
Olds			380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	380	340	300
Simonette				220	220	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260	260
Sylvan Lake			890	890	890	890	890	890	890	890	890	890	890	890	890	890	890	830	730	650	590
Waterton			430	430	410	410	410	410	410	410	410	410	410	410	410	400	400	400	400	400	400
Wimborne			370	370	370	370	370	370	370	370	370	370	370	370	360	360	350	340	320	300	200
Windfall			1250	1150	1050	1000	900	800	730	650	570	500	190	190	190	190	190	190	190	190	190
Sub-total			8210	8330	8230	8520	8450	8440	8370	8290	8160	8040	7740	7670	7550	7430	7270	7060	6720	6400	6090
Less decreased recovery from reprocessing plants			6600	6500	6400	6400	6300	6200	6100	6100	6000	5900	5700	5600	5500	5400	5300	5100	4800	4600	4300
TOTAL			6610	6830	7230	7520	7640	7690	7720	8090	8060	8040	7990	8020	8000	8030	7970	7960	7920	7800	7390
Total propane production (Table A-1 plus Table A-2)	28160	31410	38960	38970	39130	39160	39830	39690	39580	39880	39620	39300	39060	38780	37990	35970	32930	30860	28370	26940	24990

(1) Increased production from fields shown in Table A-1.
(2) Includes Carstairs field and a portion of Crossfield field.

TABLE A-3

COMPARISON OF PROPANE PRODUCTION FROM ESTABLISHED GAS RESERVES

AS FORECAST BY THE BOARD AND BY THE APPLICANTS (BARRELS PER DAY)

(1)	(2)	(3)	(4)	(5)
	Board Study			
Year	(From Existing Plant Facilities)	(Including Future Plant Facilities)	Canadian Hydrocarbons (1)	British American (2)
1966	28,200	28,200	17,000	29,800
1967	31,400	31,400	20,800	36,300
1968	32,400	39,000	21,400	39,500
1969	32,200	39,000	22,200	40,800
1970	31,900	39,100	22,700	40,500
1971	31,600	39,200	22,700	40,400
1972	32,200	39,800	22,700	40,600
1973	32,000	39,700	23,000	40,800
1974	31,900	39,600	22,700	41,300
1975	31,800	39,900	23,000	41,800
1976	31,600	39,600	22,700	42,400
1977	31,300	39,300	22,700	(3)
1978	31,100	39,100	23,000	
1979	30,800	38,800	23,000	
1980	30,000	38,000	23,300	
1981	27,900	36,000	23,300	
1982	25,000	32,900	23,300	
1983	22,900	30,900	23,600	
1984	20,500	28,400	23,800	
1985	19,100	26,900	24,100	
1986	17,600	25,000	24,400	

(1) Based primarily on existing plant facilities.

(2) Includes some production from reserves not yet developed.

(3) Estimates not available for years 1977 to 1986.

TABLE A-4

FORECAST OF PROPANE PRODUCTION FROM GAS RESERVES NOT YET DEVELOPED

(1)	(2)	(3)	(4)
Year	Gas Production From Reserves Not Yet Developed[1] (Bcf)	Propane Contained in Gas Stream Shown in Column 2[2] (Thousands of Barrels)	Propane Production[3] (Barrels Per Day)
1970	2.0	40	55
1971	4.0	80	110
1972	7.0	140	190
1973	10.0	200	270
1974	15.0	300	410
1975	20.0	400	550
1976	25.0	500	690
1977	30.0	600	820
1978	40.0	800	1100
1979	50.0	1000	1370
1980	60.0	1200	1640
1981	70.0	1400	1920
1982	80.0	1600	2190
1983	90.0	1800	2470
1984	100.0	2000	2740
1985	110.0	2200	3000
1986	130.0	2600	3560

(1) Based on detailed deliverability schedules.

(2) Based on propane content of twenty barrels per million cubic feet of gas.

(3) Based on a recovery factor of fifty per cent.

COMPARISON OF TOTAL PROPANE PRODUCTION AS FORECAST

BY THE BOARD AND BY THE APPLICANTS (BARRELS PER DAY)

	Board Study			
Year	(From Existing Plant Facilities and Two Years Growth of Gas Reserves)(1)	(Including Future Plant Facilities and Two Years Growth of Gas Reserves)(2)	Canadian Hydrocarbons(3)	British American
1966	28,200	28,200	17,000	29,800
1967	31,400	31,400	20,600	36,300
1968	32,400	39,000	21,800	39,500
1969	32,200	39,000	23,400	40,800
1970	32,000	39,200	23,300	40,500
1971	31,800	39,300	23,600	40,400
1972	32,400	40,000	24,000	40,600
1973	32,300	40,000	24,500	40,800
1974	32,300	40,000	24,600	41,300
1975	32,300	40,400	25,000	41,800
1976	32,300	40,300	25,600	42,400
1977	32,100	40,100	25,800	(4)
1978	32,200	40,200	26,400	
1979	32,100	40,200	27,200	
1980	31,600	39,600	27,500	
1981	29,900	37,900	28,000	
1982	27,200	35,100	28,600	
1983	25,400	33,300	29,100	
1984	23,200	21,100	29,400	
1985	22,100	29,900	30,200	
1986	21,200	28,600	30,500	

(1) Table A-1 plus Table A-4.
(2) Table A-2 plus Table A-4.
(3) Based primarily on existing plant facilities.
(4) Estimates not available for years 1977 to 1986.

TABLE A-6

RECOVERABLE RESERVES OF PROPANE AS OF DECEMBER 31, 1964

(1)	(2)	(3)	(4)	(5)
Plant, Field or Area	Zone	Remaining Marketable Reserves of Gas (Bcf)	Propane Recovery Ratios Barrels/MMcf of Marketable Gas	Recoverable Propane (Millions of Barrels)
A. From Existing Plant Facilities				
Acheson	Leduc and Blairmore	40	50.0	2.0
Bonnie Glen[1]	Leduc	643	28.0	18.0
Carson Creek[2]	Beaverhill Lake	368	28.0	10.3
Crossfield	Calgary Mississippian	572	11.0	6.3
Crossfield	Calgary Wabamun	571	0.5	0.3
Harmattan[3]	Mississippian	2030	18.0	36.5
Hussar[4]	Colorado and Blairmore	310	13.0	4.0
Judy Creek[5]	Beaverhill Lake	663	67.0	44.4
Leduc-Woodbend[6]	Nisku and Leduc	453	42.0	19.0
Nevis[7]	Devonian and Blairmore	220	14.0	3.1
Pembina[8]	Cardium	633	42.0	26.6
Pincher Creek	Mississippian	350	6.0	2.1
Redwater	Leduc	34	120.0	4.1
Rimbey[9]	Leduc	1800	21.0	37.8
Turner Valley	Mississippian	220	12.0	2.6
Wayne-Rosedale[10]	Viking and Blairmore	86	4.0	0.3
Willesden Green	Cardium	40	35.0	1.4
Worsley	Leduc	191	6.0	1.2
Sub-total				220.0
Edmonton Liquid Gas				10.0
Empress				95.0
TOTAL				325.0

TABLE A-6 (CONTINUED)

(1) Plant, Field or Area	(2) Zone	(3) Remaining Marketable Reserves of Gas (Bcf)	(4) Propane Recovery Ratios Barrels/MMcf of Marketable Gas	(5) Recoverable Propane (Millions of Barrels)
B. From Future Plant Facilities				
Plant on Foothills Division of Alberta Gas Trunk Line				38.0
Other plants for reprocessing of pipe line gas				5.0
Sub-total				43.0
Increased Production(11)				20.0
Carstairs(12)	Mississippian	1618	9.0	14.6
Gilby	Blairmore, Jurassic & Pekisko	599	15.0	9.0
Lookout Butte	Mississippian	400	10.0	4.0
Medicine River	Blairmore, Jurrasic & Mississippian	149	17.0	2.5
Minnehik-Buck Lake	Mississippian	384	12.0	4.6
Olds	Wabamun	250	11.0	2.8
Simonette	Wabamun & Leduc	150	18.0	2.7
Sylvan Lake	Blairmore, Jurrasic, Mississippian & Leduc	409	15.0	6.1
Waterton	Mississippian & Devonian	1197	3.0	3.6
Wimborne	Leduc	225	10.0	2.3
Windfall	Leduc	461	15.0	6.9
Sub-total				79.1
C. Less Decreased Recovery From Reprocessing Plants				58.0
TOTAL				64.1
TOTAL PROPANE RESERVE				389.1

(1) Includes Bonnie Glen, Glen Park and Wizard Lake Fields.

(2) Includes Carson Creek and Carson Creek North Fields.

(3) Includes Harmattan-Elkton and Harmattan East Fields.

TABLE A-6 (CONTINUED)

(4) THAT PORTION OF THE GAS PROCESSED IN THE TENNECO PLANT.

(5) INCLUDES SWAN HILLS, SWAN HILLS SOUTH, JUDY CREEK AND VIRGINIA HILLS FIELDS.

(6) INCLUDES LEDUC-WOODBEND AND GOLDEN SPIKE FIELDS.

(7) INCLUDES STETTLER, FENN-BIG VALLEY, HACKETT FIELDS AND THAT PORTION OF THE NEVIS GAS PROCESSED IN THE BRITISH AMERICAN PLANT.

(8) PROPANE RECOVERED AT TWO PLANTS.

(9) INCLUDES HOMEGLEN-RIMBEY AND WESTEROSE SOUTH FIELDS.

(10) THAT PORTION OF THE GAS PROCESSED AT THE CPOG PLANT.

(11) INCREASED PRODUCTION FROM FIELDS SHOWN IN TABLE A-1.

(12) INCLUDES CARSTAIRS FIELD AND A PORTION OF THE CROSSFIELD FIELD.

TABLE A-7

COMPARISON OF RECOVERABLE PROPANE RESERVES AS ESTIMATED
BY THE BOARD AND BY THE APPLICANTS (MILLIONS OF BARRELS)

	Board Study			
Propane Reserves	From Existing Plant Facilities	Including Future Plant Facilities	Canadian Hydrocarbons[1]	British American[1]
Reserves from established gas reserves	325	389	390	449
Reserves from two years growth of gas reserves	43	43	48	55
Total Recoverable Propane Reserves	368	432	438	504

(1) Reserve estimates include future plant facilities.

APPENDIX B

ALBERTA PROPANE REQUIREMENTS AND PERMIT COMMITMENT

Appendix B presents a summary of the Canadian Hydrocarbons and the British American forecast of Alberta requirements and existing permit commitments for propane and the Board's own views and estimates for the period 1966 to 1995. Some of the estimates of the applicants for individual years were not presented in their original submissions, and consequently several of the numbers shown in the tabular summaries are based on information supplied to the Board after the respective hearings. For purposes of comparison, the last forecast of Alberta propane requirements made by the Board, published in its 1961 Report[1] has also been included in the tables.

Alberta Propane Requirements

British American adopted an aggregate demand forecasting technique with a less extensive breakdown between components of demand than that afforded by the techniques employed by Canadian Hydrocarbons and the Board itself. This factor restricted the degree of direct comparison by the Board among the British American forecast, Canadian Hydrocarbons' and its own figures.

The Board recognizes that there are special difficulties in forecasting the consumption of propane since, at the present time, there is no accurate breakdown of historical data available as between the domestic, commercial, carburetion and industrial categories of end-use, upon which an estimate of future demand

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(1) Report to the Lieutenant Governor in Council with Respect to the Application under The Gas Resources Preservation Act, 1956 of Foothills Pipe Lines Ltd. June, 1961.

may be predicated. Under these conditions, although figures for total annual historical consumption exist, past and present consumption levels for such individual categories of use are estimates. This feature accentuates the usual hazards of forecasting.

Each of the following categories of consumption are considered separately: domestic and commercial, carburetion and industrial, petrochemical and miscible flood.

1. Domestic and Commercial Demand

The domestic market is defined as residential fuel demand for such purposes as space heating, hot water, cooking and refrigeration. The commercial market includes fuel demands for similar purposes by such establishments as hotels, motels, garages, restaurants, hospitals and stores.

(1) Views of Canadian Hydrocarbons - Dr. E. C. Sievwright's study

The forecast of domestic consumption was based on a review of the economic factors involved, and consultations with the applicant. Particular consideration was given to population. A forecast of rural population(2) was prepared, which anticipated a marginal rise from a figure of 489,000 in 1961 to 508,000 in 1996. This increase resulted from the net difference between two opposing trends: an expansion of the non-farm sector of the rural population, and a contraction in the farm sector. Farm population was expected to

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(2) According to the 1951 Census definition, population residing in cities, towns and villages of 1,000 or over, in addition to designated metropolitan areas, is classed as urban, the remainder being rural.

fall by 45,000 and non-farm rural to rise by 64,000. Accordingly, the proportion of the rural population represented by the non-farm element was anticipated to reach some 50 per cent by 1971, as compared to 41.5 per cent in 1961, and to level off at slightly over 50 per cent between 1971 and 1995. The average number of persons per household was assumed to increase gradually to the extent that the total number of rural households was expected to fall marginally from a figure of 120,800 in 1961 to 118,000 in 1981, and then to rise to 119,100 by 1996. Similarly to the pattern for rural population, the number of farm households was expected to fall from 68,200 in 1961 to 55,100 in 1996 and of non-farm rural households to increase from 52,600 in 1961 to 64,000 in 1996.

Consumption of propane by the two classes of rural households, farm and non-farm, was analysed separately. Per customer usage was estimated for farms as 1,700 gallons per year rising to 1,800 gallons, with the corresponding figures for non-farm rural consumers being 1,600 gallons and 1,700 gallons. These consumption rates were indicated to include 1,400 gallons for heating, the remaining amounts being for other uses. The number of farm households using propane for heating was estimated to increase from 12.0 per cent of the total in 1961 to 40.0 per cent in 1976 and 47.0 per cent in 1996 and for other uses to increase from 20.0 per cent in 1961 to 40.0 per cent in 1976 and 50.0 per cent in 1996. The saturation level for non-farm households was expected to be lower, since many have natural gas service. It was estimated to rise from 6.0 per cent in 1961 to 10.5 per cent in 1996.

Total domestic consumption was anticipated to increase from an estimated 2,600 barrels per day in 1966 to 4,600 barrels per day in 1995, with requirements over the 30-year period 1966 to 1995 amounting to some 42,048,000 barrels.

The prediction of commercial consumption was primarily based on the experience of the applicant. A 7 per cent growth rate was suggested as reasonable until 1970, followed by 5 per cent thereafter. Consequently, commercial demand was expected to increase from an estimated 1,300 barrels per day in 1966 to 5,600 barrels per day in 1995. Total commercial requirements over the 30-year period 1966 to 1995 were forecast to be some 33,544,000 barrels.

(2) Views of British American

Domestic and commercial requirements were included in the overall estimates of requirements for LPG distributors. In preparing the forecast, reference was made to a detailed energy study for the period until 1976, which indicated the proportionate distribution of total energy requirements for residential and commercial markets in Alberta. The energy study took account of such factors as population growth, age distribution, urban and rural distribution, industrial development and the competitive effects of different fuels. Energy sources other than natural gas were expected to be limited to rural areas, given the domination by gas of the domestic and commercial market in urban areas. Propane was anticipated to grow substantially as a fuel in rural areas, increasing its proportionate share of residential and commercial energy requirements in Alberta from some 5 per cent in 1961 to 8 per cent in 1976.

Forecast requirements beyond 1976 were based on a general review, principally of population distribution and urbanization, which suggested the probability of further growth, but at a slower rate than in the earlier forecast years. An annual rate of growth of 3 per cent was considered reasonable.

(3) Views of the Board

Domestic Market. In preparing its forecast of propane demand, the Board found it logical and convenient to consider the domestic market in three stages:

(a) the establishment of the market available for propane,

(b) the estimation of average consumption per household, and

(c) the estimated degree of market penetration obtainable by propane,

each of which is discussed separately below.

This method is similar to that employed by the Board in the 1961 Foothills report, the last time the Board reviewed Alberta propane requirements in detail.

(a) Propane Market. The Board initially estimated the future Alberta population by census division. It used a prior forecast made by the Board staff, adopted in the November, 1964, Trans-Canada Pipe Lines Limited and Alberta and Southern Gas Co. Ltd., Report.(3) This projection is somewhat more optimistic than that of Canadian Hydrocarbons, with the difference

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(3) OGCB Report 64-11 on Applications of Trans-Canada Pipe Lines Limited and Alberta and Southern Gas Co. Ltd. under The Gas Resources Act, 1956. November, 1964.

amounting to some 570,000 by 1991, attributable in the main to a somewhat greater anticipated urban growth. The difference in urban population estimates has little bearing on any differences between the respective forecasts of propane consumption, since both the Board and Canadian Hydrocarbons assume that urban areas will be served predominantly by natural gas, and thus excluded from the propane market. The Board is in agreement with Canadian Hydrocarbons trend for farm population, that is, a further decline over the forecast period. However, it believes that the level of future economic activity in the Province will justify the expected higher level of urban and semi-urban population.

The Board established by census division the potential population to be served by propane by subtracting an estimate of that part of the Alberta population served by gas produced from presently known gas reserves, from the total population forecast, on the assumption that gas, when available, will usually supplant any other fuel. The population to be served by gas was estimated by applying expected urban population growth rates to those centres currently served by gas, and to those anticipated to be served in the future, following appropriate phasing in of new centres of gas consumption.

This procedure differs somewhat from that adopted by Canadian Hydrocarbons Limited and by the Board in 1961, where a distinction was made between the rural farm and rural non-farm population sectors, and the impact of gas on the latter was indicated in terms of relative saturation levels.

The number of potential domestic propane customers was forecast by the Board by dividing the potential propane consuming population by an estimated number of persons per household by census division. This estimated number of persons per household varied as between census divisions, but was held constant within each census division throughout the forecast period. Although the census data indicate there has been a slight increase in the number of persons per household over the years 1951 to 1961, the Board did not consider the trend sufficiently significant to project into the future, whereas Canadian Hydrocarbons did allow for some future increase in this ratio.

(b) Average Consumption per Household. The Board prepared estimates of average consumption per household in 1964, based primarily on data relating to 1963, on a census division basis. The range of variation between census divisions was from some 1,200 gallons per annum to some 1,800 gallons per annum. The versatility of propane, and increasing familiarity with the fuel by consumers, was assumed to result in gradually increasing consumption per household, with the result that by 1979 the range of variation by census division was forecast to be from 1,775 gallons per year to 1,975 gallons per year, as compared to Canadian Hydrocarbons farm customer usage of 1,700 gallons per year in 1964 escalating to 1,800 gallons per year by 1981.

As mentioned in (a) above, Canadian Hydrocarbons considered the farm and non-farm market separately, and indicated a

difference of 100 gallons per year in consumption levels between these sectors for those households using propane both for heating and other purposes. Canadian Hydrocarbons also indicated somewhat more extensive use of propane in farm areas by estimating the number of households using propane for other uses, but not for heating. The Board recognizes that one of the virtues of separate treatment of the farm and non-farm market is the opportunity of ascribing different consumption rates to each sector. However, in the absence of firm data relating to any such differences in consumption levels, the Board did not feel justified in making any distinction, and preferred to employ an overall average rate.

(c) Market Penetration. To forecast the degree to which propane will penetrate what was considered to be the market available to it, that is, the fuel market exclusive of gas, the Board initially estimated the degree of penetration in each census division achieved by 1964. This resulted from a consideration of trends exhibited by census figures, and of the necessity to reconcile total estimates of propane consumption for all uses, including domestic use, with actual reported consumption. Future growth in propane penetration was related to comparative fuel prices and trends in fuel use, having regard for variations by census division throughout the Province. Saturation levels were assumed to be reached within fifteen years. The Board believes that this procedure of applying an estimated degree of market penetration to the potential propane market possesses some advantage over the method adopted by

Canadian Hydrocarbons and by the Board in 1961, whereby differential penetration levels were applied to the farm and non-farm sectors of the rural market, with a lower rate applying to the latter to reflect incursions of gas.

In summary, the Board estimates that domestic consumption will increase from some 3,400 barrels per day in 1966 to some 6,000 barrels per day by 1979, and then rise more slowly to a level of some 6,800 barrels per day by 1995. Total thirty-year requirements over the period 1966 to 1995 were forecast to be some 60,408,000 barrels.

Table B-1 shows a comparison between the Board's 1961 forecast, its current forecast and Canadian Hydrocarbons' forecast. The table indicates a significant difference between the Canadian Hydrocarbons' forecast and that by the Board.

The Board notes that the market penetration ratios used by Canadian Hydrocarbons vary from 12.0 per cent for the farm market and 6.0 per cent for the rural non-farm market in 1961 to 47.0 per cent and 10.5 per cent respectively by 1996. Thus the ratio of the relative proportions of the market served by propane in the farm and non-farm sector increases from 2 in 1961 to over 4 by 1996, resulting in continually decreasing emphasis being given to the non-farm rural markets. The Board is in reasonable agreement with the penetration ratios used for the farm market over the forecast period. Since Canadian Hydrocarbons has primarily ascribed the difference in penetration levels between the farm and non-farm sectors of the rural market to extensions in gas

service to non-farm areas, the Board investigated the relationship between the total population, the population estimated to be served by gas and the farm and non-farm sectors of the rural population for the census year 1961 and the forecast years. The results indicated to the Board that Canadian Hydrocarbons may have overestimated the extent to which natural gas has made inroads into the non-farm rural fuel market, and hence to have underestimated the domestic market for propane. Overall, therefore, the Board believes the Canadian Hydrocarbons estimate of domestic consumption to be low.

Commercial Market. The Board's forecast of commercial consumption is related closely to its forecast of domestic consumption. A forecast was made of the number of commercial establishments corresponding to the non-gas consuming population by census division by utilizing the potential propane population calculated for purposes of estimating domestic consumption, as outlined in the preceding section. The prediction was based on estimates of the number of commercial establishments per thousand of rural population, as indicated by census data. These ratios were generally held constant over the forecast period. However, special consideration was given to tourist and resort areas, where the number of establishments per thousand of population may increase over time. On the assumption that market penetration would be similar for domestic and commercial consumption of propane, the expected number of commercial establishments using propane was calculated by applying the same penetration ratios as used for the domestic forecast to the estimated potential

propane consuming commercial establishments. Propane consumption by commercial customers was then forecast by applying an estimate of average consumption per customer, which escalated in a manner equivalent to the domestic forecast over a period of fifteen years, to the estimated number of commercial establishments using propane.

The Board estimates that commercial consumption will grow from some 900 barrels per day in 1966 to 1,600 barrels a day in 1979, and then to grow more slowly to a level of 1,800 barrels per day in 1995. Total thirty-year requirements were forecast to be some 15,987,000 barrels.

Table B-1 shows that the Board forecast differs considerably from that of Canadian Hydrocarbons, with the level of consumption estimated by the latter being over three times that calculated by the Board in 1995. This is attributable partly to a higher estimate of actual consumption in 1963 by Canadian Hydrocarbons, to which it applied postulated rates of growth, and partly to the higher anticipated average rate of growth over the forecast period of some 5.2 per cent, as compared to a figure of some 2.4 per cent estimated by the Board.

In contrast to its postulated rate of growth of commercial consumption, the forecast of domestic consumption by Canadian Hydrocarbons increases at an average cumulative ratio of 2.0 per cent over the thirty-year period. The Board believes that several determinants of future consumption are common to both the domestic and commercial categories of consumption, for instance, population growth in areas not consuming gas,

comparative fuel prices and trends in the share of the potential propane market actually achieved by propane. Therefore it does not appear reasonable to the Board that the domestic and commercial categories should exhibit such markedly divergent rates of growth. In contrast, the present method used by the Board employs identical rates of growth for domestic and commercial consumption. Although the Board recognizes that there may be variations in growth between the two categories, it believes that in the absence of firm evidence demonstrating such variations, and in view of the common aspects indicated above, the assumption of the same growth rate for each category is justified.

To appraise the Canadian Hydrocarbons estimate of actual commercial consumption, which served as a base for future growth, the Board investigated these figures in relation to an estimate of the number of commercial propane customers. The results indicated that the level of actual consumption estimated by Canadian Hydrocarbons implied a per customer usage somewhat higher than suggested by information supplied to the Board by propane marketers and other organizations. The Board, therefore, believes that the initial estimates of Canadian Hydrocarbons which serves as a bench-mark for future projections, are high. A similar analysis was applied by the Board to the Canadian Hydrocarbons consumption estimate of 5,600 barrels per day in 1995, which rate was found to imply a growth in the level of per customer usage of a magnitude considerably greater than

believed likely by the Board. Furthermore, Canadian Hydrocarbons expects the level of commercial consumption to exceed that for domestic consumption by 1990. In the opinion of the Board, it appears improbable that the commercial category of use will ever be greater than the domestic. Overall, therefore, the Board considers the Canadian Hydrocarbons' forecast of commercial consumption to be too high.

(4) Table B-1

Table B-1 shows a comparison of the Canadian Hydrocarbons, the current Board and the Board 1961 forecasts in terms of the year by year figures from 1966 to 1995, the thirty-year requirements and average annual cumulative rates of growth. The breakdown of the Board 1961 forecast as between the domestic and commercial categories is not available.

For the domestic and commercial figures combined, the Canadian Hydrocarbons and current Board forecasts are in close agreement, particularly with respect to the thirty-year requirements and average rates of growth over the first fifteen forecast years. On the annual basis, the Board figures are somewhat higher in the earlier years, and lower in the later years. Both forecasts are higher than the 1961 Board forecast, which is to some extent a reflection of the fact that the early years of this prediction were probably low in relation to the actual levels of domestic and commercial consumption achieved prior to 1966. The total figures, however, mask substantial differences between the individual domestic and commercial forecasts. The overall average rate of growth of the Canadian Hydrocarbons

commercial forecast is more than double that of the Board, while its domestic growth rate is nearly one-half of a per cent lower than the Board's. The variations in the initial levels of consumption estimated for 1966 accentuate the effect of these different rates of growth on the comparison of the respective forecasts.

2. Carburetion and Industrial Requirements for Propane

(1) Views of Canadian Hydrocarbons

The estimates of both carburetion and industrial consumption were based upon the experience of the applicant.

Carburetion. Carburetion sales were defined as including all carburetion for road or farm use, including irrigation and fork-lift demand. A 7 per cent growth rate was postulated until 1970, followed by 5 per cent until 1995, from a base level of 270 barrels per day in 1963. Consumption by 1995 was anticipated to be some 1,470 barrels per day. The rate of growth was expected to be somewhat low in the light of the many new agricultural uses in the United States, but climatic conditions were considered to favour such applications in the southern states. At the hearing, Dr. Sievwright stated that he believed that following recent developments the carburetion estimates may be somewhat conservative.

Industrial. This category was considered to include sales for such purposes as gravel drying, oil field pumps, kilns, lumber drying, plant heating and weed flaming. Such a broad range of applications, and the possibility of new uses, indicated to the applicant that a 7 per cent growth rate until 1970, and

5 per cent thereafter was appropriate.

In total, carburetion and industrial consumption of propane was expected to increase from an estimated 700 barrels per day in 1966 to some 3,000 barrels per day by 1995, with thirty-year requirements amounting to 18 million barrels.

(2) Views of British American

No specific data was presented in relation to carburetion and industrial consumption of propane. However, both categories were expected to exhibit substantial growth rates, but from relatively small initial levels. At the hearing, Mr. West, the witness for the applicant, indicated that the current level of industrial use was unlikely to exceed the range of 150 to 200 barrels per day. British American also believed that the combined total consumption by the two categories would be less than 1,000 barrels per day in 1976.

(3) Views of the Board

Carburetion. The Board forecast considered four separate components of carburetion demand: tractors, fork-lift trucks, vehicles and buses.

A forecast was made of the total number of tractors in Alberta, which was expected to rise from an estimated level of some 108,000 in 1966 to some 125,000 by 1995. The number of such tractors powered by propane was estimated having regard for the possible current number of propane powered tractors in Alberta, the advantages of these tractors with respect to maintenance and engine wear, and the degree of sales effort by industry. It was assumed

that the proportion of new tractor sales represented by propane powered tractors would increase from an estimated level of 10 per cent in 1966 to 15 per cent in 1976, at which proportion it was held constant for the remainder of the forecast period. Consequently the number of propane tractors in Alberta was anticipated to rise from an estimate of some 3,000 units in 1966 to about 19,000 in 1995, given a relatively vigorous sales initiative by the industry. Average consumption of propane by tractors was based on a variety of industry estimates, and amounted to 2,000 gallons per year per tractor. This number was held constant over the entire forecast period.

Propane is gaining increasing acceptance as fuel for fork-lift trucks, particularly for warehouse use, despite possible higher fuel costs, on account of the less frequent maintenance required and less noxious fumes as compared to diesel fuel or gasoline. According to data supplied by industry, there existed approximately one hundred propane powered fork-lift trucks in January 1965. This number was expected to rise to over one thousand by the end of the forecast period. Constant average annual consumption was estimated to be some 1,800 gallons per year.

Most of the vehicle consumption of propane is used in trucks operated by the propane industry. It was assumed that the growth in such sales would generally parallel the growth in domestic and commercial demand, with the requirement to serve an expanding market.

Currently the Edmonton Transit System uses 30 propane-powered buses, consuming approximately 230,000 gallons of propane per year. The Board is informed by the ETS that the trend for its operations is towards using diesel power. Consequently the Board assumed the System would not extend its current fleet of propane-powered buses and therefore anticipated that this source of demand for propane would not exist after 1977.

Industrial. Average rates of growth reflecting industry expectations were applied to an estimate of industrial consumption in 1966 with a higher rate from 1966 to 1979 reducing to a lower rate over the period 1980 to 1995. The differential rates were intended to reflect a relatively rapid growth over the earlier years of the forecast, during which time the market would be developed from the current low level. By 1979 it was assumed that a degree of saturation would have been reached such that growth in subsequent years would be at a reduced rate.

Industrial and carburetion consumption of propane was forecast to increase from an estimated 700 barrels per day to 1966 to 4,200 barrels per day in 1995, with thirty-year requirements amounting to some 31,000,000 barrels.

(4) Table B-2

Table B-2 shows a comparison between the Canadian Hydrocarbons, current Board and Board 1961 forecast. The considerable difference between the current Board and the Canadian Hydrocarbons and Board 1961 forecast is primarily attributable to the Board estimate of tractor consumption of propane. This item in the

forecast is predicated on an aggressive marketing effort by industry in this field, with the major portion of the expansion being in the period up to 1980. Although the witness for Canadian Hydrocarbons indicated that its estimates may be low, the Board recognizes that the current Board prediction of carburetion consumption is optimistic.

A compensating factor in terms of the combined industrial and carburetion consumption estimates is provided by the Canadian Hydrocarbons industrial forecast, which is higher than the Board's. The Board found it difficult to assess the industrial estimates in view of the fact that the data for this category of use are particularly sparse. Nevertheless, in relation to what data the Board does possess, it believes that the Canadian Hydrocarbons estimate of industrial consumption to be somewhat high, although further new applications may substantiate the Canadian Hydrocarbons' projection..

(5) Table B-3

The British American forecast showed no breakdown between domestic, commercial, carburetion and industrial consumption of propane. It has not been feasible, therefore, to include British American figures in Tables B-1 and B-2. However, the combined total for the above four categories of use was designated by British American as demand by LPG distributors. British American also listed a category of demand miscellaneous use, which was forecast as a constant 1,200 barrels per day. This comprised such consumption as field and plant use, losses, and a category statistically reported by the Board as "refinery

and other". "Refinery and other" consumption amounted to some 200 barrels per day in 1964 and this amount has been added to British American's year by year forecast LPG distributors demand, since it is principally industrial and carburetion consumption. The remaining 1,000 barrels per day has not been included in British American's demand figures, since the Board has treated such items as plant and field consumption and losses as a deduction from supply, rather than as a demand.

To permit comparison, Table B-3 shows the forecast by British American, adjusted as noted above for miscellaneous use, and the Canadian Hydrocarbons, the current Board and the Board in 1961 for the domestic, commercial, carburetion and industrial demand categories combined.

All three current forecasts are higher than the Board's 1961 estimates. This is to be expected in view of the latter forecast being low in its initial years. The difference between the current Board forecast and the British American and Canadian Hydrocarbons projections is to a significant extent attributable to the Board's estimates of carburetion consumption. The British American and Canadian Hydrocarbons forecasts both exhibit a similar pattern in relation to the current Board figures, being lower in the earlier forecast years, and higher in the last few years.

3. Miscible Flood Demand

(1) Views of Canadian Hydrocarbons

The applicant adopted the Board's forecast shown in the

1961 Foothills report.[4]

(2) Views of British American

British American expressed the belief that miscible flood demand would amount to approximately 1,000 barrels per day in 1965, would fall to 700 barrels per day in 1966, and be zero in 1967 and 1968, following the completion of existing projects. It was then assumed that the peak 1962 demand of 1,900 barrels per day would resume in 1969, by which time fields developed since 1965 and suitable for miscible operation would be available for flooding. The level of 1,900 barrels per day forecast for 1969 was extended throughout the forecast period.

(3) Views of the Board

The Board drew a distinction between miscible flood requirements it considered "self-sustaining" and those of a "non self-sustaining" character. The former category embraced schemes which obtained propane supply from the cycling of crude oil, while the latter category included those schemes utilizing propane supply from gas processing plants. Since the potential production of propane for self-sustaining schemes was not included by the Board as part of the Alberta supply available to meet requirements, it has correspondingly been excluded from the demand forecast. Hence the Board forecast of miscible flood requirements solely relates to non self-sustaining demand.

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(4) Report to the Lieutenant Governor in Council with Respect to the Application under The Gas Resources Preservation Act, 1956 of Foothills Pipe Lines Ltd. June 1961.

The prediction of non self-sustaining demand for the years 1966 to 1968 includes the estimated requirements of the Pan American Petroleum Corporation's Pembina Lobstick scheme, and a margin to cover another such scheme. The anticipated level of demand for 1970 and thereafter of 1,000 barrels per day is equivalent to providing for the requirements of approximately three schemes of the magnitude of Pan American's Lobstick in any one year.

Thus the Board forecast that miscible flood demand would increase from 500 barrels per day in 1966 to 1,000 barrels per day in 1970, at which level it was postulated to remain constant. Total requirements over the thirty-year period 1966 to 1995 were expected to be some 10,366,000 barrels.

(4) Table B-4

Table B-4 shows the comparative forecasts of Canadian Hydrocarbons, British American and the Board. Since Canadian Hydrocarbons adopted the Board 1961 forecast, this forecast has not been shown under a separate heading. The differences between the projections are considerable, with the previous 1961 Board forecast being more than double the current Board figures. Similarly, the British American forecast is significantly in excess of that by the Board. However, the Board considers that in view of the distinction it made between self-sustaining and non self-sustaining schemes, with only the latter category included as a requirement, the forecast figures shown are not directly comparable. It believes that both the British American and Board 1961 forecast include some requirements the

Board has currently treated as self-sustaining.

4. Petrochemical Demand

(1) Views of Canadian Hydrocarbons

The applicant adopted the Board forecast published in the 1961 Foothills report[5], and indicated that although on the basis of the 1963 consumption the forecast seemed low, the rate of growth assumed between 1965 and 1968 may close any gap between the anticipated and actual consumption.

(2) Views of British American

British American postulated a 5 per cent growth rate for this category of demand. The market was considered as one particularly susceptible to technological change and hence difficult to predict. No provision was made for facilities to be constructed in the future. The estimate applied to the existing plant of the present single consumer in the Province, Chemcell (1963) Limited.

(3) Views of the Board

The Board distinguished between the future demand by Chemcell and that which may be attributable to other petrochemical plants utilizing propane feedstock in Alberta.

Chemcell. This company is currently the sole petrochemical consumer of propane feedstock in the Province. As a forecast of Chemcell's requirements to 1978, the Board adopted the figures submitted by the company as Exhibit 4 at the Canadian Hydrocarbons hearing. A linear extrapolation of these figures

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(5) Report to The Lieutenant Governor in Council with Respect to the Application under The Gas Resources Preservation Act, 1956, of Foothills Pipe Lines Ltd. June 1961.

was used to estimate requirements from 1978 to 1995.

Future Petrochemical Plants. Although the Board possesses no definitive information at this time to indicate that petrochemical plants designed to utilize propane feedstock will be constructed in the future in Alberta, nevertheless it believes it proper to make some provision for such an eventuality, since it considers that the continuing economic growth and availability of propane in the Province will encourage further expansion in the field of petrochemicals. The Board has therefore included in its forecast a 1,500 barrels per day increase in both 1970 and 1980, over and above Chemcell's requirements. This adjustment is intended to reflect the possibility of the establishment of two more propane-using petrochemical plants in Alberta.

The Board forecasts that petrochemical demand for propane will increase from some 3,500 barrels per day in 1966 to some 14,600 barrels per day in 1995, with total requirements over the thirty-year period 1966 to 1995 amounting to some 103,003,000 barrels.

(4) Table B-5

Table B-5 shows the Canadian Hydrocarbons, British American and Board projections of petrochemical demand in Alberta. The Board 1961 forecast has not been shown under a separate heading, since it was adopted by Canadian Hydrocarbons.

The Board 1961 forecast and the British American projection are very close, although based on different premises, with the Board 1961 figures intending to provide for other major propane

consumers in the petrochemical field, while British American made no provision for such a contingency. The current Board projection is substantially higher, a reflection of the specific contingencies for the location of two more propane-using petrochemical plants in the Province.

5. Table B-6

The forecasts of total consumption of propane in Alberta, composed of domestic, commercial, carburetion, industrial, miscible flood and petrochemical demand, by Canadian Hydrocarbons, British American, the current Board and the Board in 1961 are shown in Table B-6.

In the initial year, 1966, the Board 1961 forecast is higher than British American's or the Board's current forecast, the difference being attributable principally to miscible flood demand. Since Canadian Hydrocarbons adopted the Board 1961 figures for miscible flood demand, this factor also substantially accounts for the Canadian Hydrocarbons forecast being higher than British American's or the Board's.

For the last forecast year, 1995, the Canadian Hydrocarbons, British American and Board figures are in agreement, all being approximately 2,000 barrels per day higher than the Board 1961 estimate. In terms of the thirty-year requirements, the Board's current estimate is noticeably higher than that of British American or Canadian Hydrocarbons. This fact is in part a reflection of the more rapid rate of growth postulated by the Board in the first half of the forecast period.

6. Permit Commitment

One company, Pacific Petroleums Ltd., currently holds a Permit No. PP 62-1 to remove propane from the Province. The term of the permit is 17 years running to May 14, 1981, and the amounts are no more than 9,600 barrels per day in any consecutive 12-month period nor more than 56,000,000 barrels during the term of the permit.

(1) Views of Canadian Hydrocarbons

Canadian Hydrocarbons forecasts that the volumes of propane removed by Pacific Petroleums would escalate to the maximum authorized permit volumes by 1969. These volumes were extended after the termination of the permit in 1981 until the end of the forecast period in 1995, on the grounds that the Empress plant and facilities would remain in use after 1981, and would constitute a prior claim to remove product from the Province. Dr. Sievwright, the witness for the applicant, indicated at the hearing that the period over which it was assumed the volumes removed at the Pacific plant would escalate to reach the maximum permit level appeared to be conservative.

The total volumes required over the thirty-year period 1966 to 1995 were forecast to be some 102,821,000 barrels.

(2) Views of British American

British American assumed the maximum approved annual volumes for Pacific's plant would be reached by 1966, and would be maintained at this level through to 1981, at which time it terminated this requirement. Total requirements over the thirty-

year period were predicted to be some 56,064,000 barrels.

(3) Views of the Board

The Board estimated that, on the basis of the current data and the indicated near term future, the maximum permit volumes of 9,600 barrels per day would be reached in 1968, and then extended this level until 1979. To conform with the permit limitation on the total removal of propane of 56,000,000 barrels, and taking account of production prior to 1966, the Board expected production in 1981 would be 8,300 barrels per day, which rate would result in total propane production to that date being equivalent to that allowed by the permit. No production was therefore forecast for 1981.

The Board has not made any provision for permit commitments for the Empress plant after this time, since the granting of the permit does not imply any prior commitment on propane removed from the Province after the termination of the permit. In closing argument at the hearing, Mr. MacKimmie, counsel for Canadian Hydrocarbons, indicated agreement with this principle. Total requirements over the forecast period 1966 to 1995 therefore were expected to be some 51,794,000 barrels.

(4) Table B-7

Table B-7 shows the forecast of Alberta permit commitments by Canadian Hydrocarbons, British American and the Board.

Summary

Table B-8 summarizes total requirements for Alberta propane as forecast by Canadian Hydrocarbons, British American and the

Board. A comparison of this Table with Table B-6 shows that the assumption by Canadian Hydrocarbons of the extension of Pacific Petroleums Empress plant requirements beyond the permit period significantly raises its estimate of thirty-year requirements to some 20 million barrels more than the Board, and some 50 million more than British American.

TABLE B-1

FORECAST DOMESTIC AND COMMERCIAL REQUIREMENTS

OF PROPANE IN ALBERTA 1966-1995

(Barrels Per Day)

Year	Domestic Requirements		Commercial Requirements		Domestic and Commerci Requirements		
	Canadian Hydrocarbons	Current Board	Canadian Hydrocarbons	Current Board	Canadian Hydrocarbons	1961 Board *	Cur Bo
1966	2,600	3,400	1,300	900	3,900	3,500	4,
1967	2,800	3,600	1,400	900	4,200	3,800	4,
1968	2,900	3,700	1,500	1,000	4,400	4,100	4,
1969	3,000	3,900	1,600	1,000	4,600	4,300	4,
1970	3,200	4,000	1,700	1,100	4,900	4,500	5,
1971	3,300	4,200	1,800	1,100	5,100	4,700	5,
1972	3,400	4,400	1,900	1,200	5,300	4,900	5,
1973	3,400	4,600	2,000	1,200	5,400	5,100	5,
1974	3,500	4,800	2,100	1,300	5,600	5,300	6,
1975	3,500	4,900	2,200	1,300	5,700	5,500	6,
1976	3,600	5,200	2,300	1,400	5,900	5,700	6,
1977	3,700	5,400	2,400	1,400	6,100	5,900	6,
1978	3,700	5,700	2,500	1,500	6,200	6,100	7,
1979	3,800	6,000	2,600	1,600	6,400	6,300	7,
1980	3,900	6,000	2,700	1,600	6,600	6,400	7,
1981	4,000	6,000	2,900	1,600	6,900	6,500	7,
1982	4,000	6,100	3,000	1,600	7,000	6,600	7,
1983	4,100	6,100	3,200	1,600	7,300	6,700	7,
1984	4,100	6,200	3,300	1,600	7,400	6,800	7,
1985	4,200	6,200	3,500	1,600	7,700	6,900	7,
1986	4,300	6,300	3,700	1,700	8,000	6,900	8,
1987	4,300	6,300	3,900	1,700	8,200	7,000	8,
1988	4,400	6,400	4,000	1,700	8,400	7,000	8,
1989	4,400	6,400	4,200	1,700	8,600	7,000	8,
1990	4,400	6,500	4,400	1,700	8,800	7,100	8,
1991	4,500	6,500	4,700	1,700	9,200	7,100	8,
1992	4,500	6,600	4,900	1,700	9,400	7,100	8,
1993	4,500	6,600	5,200	1,800	9,700	7,100	8,
1994	4,600	6,700	5,400	1,800	10,000	7,200	8,
1995	4,600	6,800	5,600	1,800	10,200	7,200	8,
30 Year Requirements ('000's of Barrels)	42,048	60,408	33,544	15,987	75,592	65,810	76,3
Average Annual Cumulative Growth Rate (%)							
1966-1981	2.9	3.9	5.5	3.9	3.9	4.2	3.9
1981-1995	1.0	0.9	4.8	0.9	2.8	0.7	0.9
1966-1995	2.0	2.4	5.2	2.4	3.4	2.5	2.4

* 1991-1995: Projection of 1961 forecast

TABLE B-2

FORECAST CARBURETION AND INDUSTRIAL REQUIREMENTS OF PROPANE IN ALBERTA 1966 - 1995

(Barrels Per Day)

Year	Canadian Hydrocarbons	1961 Board*	Current Board
1966	700	500	700
1967	800	600	800
1968	800	700	1,000
1969	800	800	1,100
1970	900	900	1,300
1971	1,000	1,000	1,500
1972	1,000	1,100	1,700
1973	1,100	1,300	1,900
1974	1,100	1,400	2,100
1975	1,200	1,500	2,200
1976	1,200	1,600	2,400
1977	1,200	1,700	2,600
1978	1,300	1,800	2,800
1979	1,400	1,900	3,000
1980	1,500	2,000	3,100
1981	1,600	2,100	3,200
1982	1,600	2,200	3,300
1983	1,700	2,200	3,400
1984	1,800	2,400	3,500
1985	1,900	2,400	3,600
1986	2,000	2,600	3,700
1987	2,100	2,600	3,700
1988	2,200	2,700	3,800
1989	2,300	2,800	3,900
1990	2,400	2,900	4,000
1991	2,500	2,900	4,000
1992	2,600	3,100	4,100
1993	2,800	3,100	4,100
1994	2,900	3,300	4,200
1995	3,000	3,300	4,200
30-Year Requirements Thousands of Barrels	18,031	21,681	30,989
Average Annual Cumulative Growth Rate (%)			
1966-1981	5.7	10.0	10.7
1981-1995	4.6	3.3	2.0
1966-1995	5.1	6.7	6.4

* 1991 - 1995 - Projection of 1961 forecast. Includes requirements in fringe areas.

TABLE B-3

FORECAST DOMESTIC, COMMERCIAL, CARBURETION AND

INDUSTRIAL REQUIREMENTS OF PROPANE IN ALBERTA 1966-1995

(Barrels Per Day)

Year	Canadian Hydrocarbons	British American	1961 Board*	Current Board
1966	4,600	4,500	4,000	5,000
1967	5,000	4,700	4,400	5,300
1968	5,200	5,000	4,800	5,700
1969	5,400	5,300	5,100	6,000
1970	5,800	5,600	5,400	6,400
1971	6,100	5,900	5,700	6,800
1972	6,300	6,300	6,000	7,300
1973	6,500	6,600	6,400	7,700
1974	6,700	7,000	6,700	8,200
1975	6,900	7,400	7,000	8,400
1976	7,100	7,800	7,300	9,000
1977	7,300	8,000	7,600	9,400
1978	7,500	8,300	7,900	10,000
1979	7,800	8,500	8,200	10,600
1980	8,100	8,700	8,400	10,700
1981	8,500	9,000	8,600	10,800
1982	8,600	9,300	8,800	11,000
1983	9,000	9,500	8,900	11,100
1984	9,200	9,800	9,200	11,300
1985	9,600	10,100	9,300	11,400
1986	10,000	10,400	9,500	11,700
1987	10,300	10,700	9,600	11,700
1988	10,600	11,000	9,700	11,900
1989	10,900	11,300	9,800	12,000
1990	11,200	11,600	10,000	12,200
1991	11,700	12,000	10,000	12,200
1992	12,000	12,300	10,200	12,400
1993	12,500	12,700	10,200	12,500
1994	12,900	13,000	10,500	12,700
1995	13,200	13,400	10,500	12,800
30-Year Requirements Thousands of Barrels	93,623	96,981	87,491	107,383
Average Annual Cumulative Growth Rate (%)				
1966-1981	4.2	4.7	5.2	5.3
1981-1995	3.2	2.9	1.4	1.2
1966-1995	3.7	3.8	3.4	3.3

* 1991-1995: Projection of 1961 forecast. Includes carburetion and industrial requirements in fringe areas.

TABLE B-4

FORECAST MISCIBLE FLOOD REQUIREMENTS OF

PROPANE IN ALBERTA 1966 - 1995

(Barrels Per Day)

Year	Canadian Hydrocarbons(2)	British American	Current Board(1)
1966	2,500	700	500
1967	2,500	-	500
1968	2,500	-	700
1969	2,500	1,900	700
1970	2,500	1,900	1,000
1971	2,500	1,900	1,000
1972	2,500	1,900	1,000
1973	2,500	1,900	1,000
1974	2,500	1,900	1,000
1975	2,500	1,900	1,000
1976	2,500	1,900	1,000
1977	2,500	1,900	1,000
1978	2,500	1,900	1,000
1979	2,500	1,900	1,000
1980	2,500	1,900	1,000
1981	2,400	1,900	1,000
1982	2,400	1,900	1,000
1983	2,300	1,900	1,000
1984	2,300	1,900	1,000
1985	2,200	1,900	1,000
1986	2,200	1,900	1,000
1987	2,100	1,900	1,000
1988	2,100	1,900	1,000
1989	2,000	1,900	1,000
1990	2,000	1,900	1,000
1991	2,000	1,900	1,000
1992	2,000	1,900	1,000
1993	1,900	1,900	1,000
1994	1,900	1,900	1,000
1995	1,900	1,900	1,000
30-Year Requirements Thousands of Barrels	25,258	18,980	10,366

(1) Current Board forecast solely relates to non self-sustaining demand.

(2) 1991-1995 Projection of Board 1961 Forecast by Canadian Hydrocarbons.

TABLE B-5

FORECAST PETROCHEMICAL REQUIREMENTS FOR

PROPANE IN ALBERTA 1966 - 1995

(Barrels Per Day)

Year	Canadian Hydrocarbons	British American	Current Board
1966	2,700	3,600	3,500
1967	3,000	3,800	3,600
1968	3,300	4,000	3,600
1969	3,600	4,200	3,700
1970	3,900	4,400	5,500
1971	4,200	4,600	6,100
1972	4,500	4,800	6,500
1973	4,800	5,000	6,900
1974	5,100	5,200	6,900
1975	5,400	5,400	6,900
1976	5,700	5,600	7,400
1977	6,000	5,900	7,700
1978	6,300	6,200	8,000
1979	6,600	6,500	8,300
1980	7,000	6,800	10,100
1981	7,300	7,100	10,400
1982	7,600	7,500	10,700
1983	8,000	7,900	11,000
1984	8,400	8,300	11,300
1985	8,800	8,700	11,600
1986	9,200	9,100	11,900
1987	9,600	9,600	12,200
1988	10,100	10,000	12,500
1989	10,700	10,600	12,800
1990	11,300	11,100	13,100
1991	11,900	11,600	13,400
1992	12,500	12,200	13,700
1993	13,100	12,800	14,000
1994	13,700	13,500	14,300
1995	14,300	14,100	14,600
30-Year Requirements Thousands of Barrels	83,439	83,987	103,003
Average Annual Cumulative Growth Rate (%)			
1966 - 1981	6.9	4.6	7.5
1981 - 1995	4.9	5.0	2.4
1966 - 1995	5.9	4.8	5.1

TABLE B-6

FORECAST TOTAL REQUIREMENTS FOR PROPANE

IN ALBERTA 1966 - 1995

(Barrels Per Day)

Year	Canadian Hydrocarbons	British American	1961 Board*	Current Board
1966	9,800	8,800	9,200	9,000
1967	10,500	8,500	9,900	9,400
1968	11,000	9,000	10,600	10,000
1969	11,500	11,400	11,200	10,400
1970	12,200	11,900	11,800	12,900
1971	12,800	12,400	12,400	13,900
1972	13,300	13,000	13,000	14,800
1973	13,800	13,500	13,700	15,600
1974	14,300	14,100	14,300	16,100
1975	14,800	14,700	14,900	16,300
1976	15,300	15,300	15,500	17,400
1977	15,800	15,800	16,100	18,100
1978	16,300	16,400	16,700	19,000
1979	16,900	16,900	17,300	19,900
1980	17,600	17,400	17,900	21,800
1981	18,200	18,000	18,300	22,200
1982	18,600	18,700	18,800	22,700
1983	19,300	19,300	19,200	23,100
1984	19,900	20,000	19,900	23,600
1985	20,600	20,700	20,300	24,000
1986	21,400	21,400	20,900	24,600
1987	22,000	22,200	21,300	24,900
1988	22,800	22,900	21,900	25,400
1989	23,600	23,800	22,500	25,800
1990	24,500	24,600	23,300	26,300
1991	25,600	25,500	23,900	26,600
1992	26,500	26,400	24,700	27,100
1993	27,500	27,400	25,200	27,500
1994	28,500	28,400	26,100	28,000
1995	29,400	29,400	26,700	28,400
30-Year Requirements Thousands of Barrels	202,320	199,947	196,188	220,752
Average Annual Cumulative Growth Rate (%)				
1966 - 1981	4.2	4.9	4.7	6.2
1981 - 1995	3.5	3.6	2.7	1.8
1966 - 1995	3.9	4.2	3.7	4.0

*1991 - 1995: Projection of 1961 forecast. Includes carburetion and industrial requirements in fringe areas.

TABLE B-7

ALBERTA PERMIT COMMITMENT 1966 - 1995

(Barrels Per Day)

Year	Canadian Hydrocarbons	British American	Board
1966	6,500	9,600	8,900
1967	7,500	9,600	9,500
1968	8,500	9,600	9,600
1969	9,600	9,600	9,600
1970	9,600	9,600	9,600
1971	9,600	9,600	9,600
1972	9,600	9,600	9,600
1973	9,600	9,600	9,600
1974	9,600	9,600	9,600
1975	9,600	9,600	9,600
1976	9,600	9,600	9,600
1977	9,600	9,600	9,600
1978	9,600	9,600	9,600
1979	9,600	9,600	9,600
1980	9,600	9,600	8,300
1981	9,600	9,600	-
1982	9,600	-	-
1983	9,600	-	-
1984	9,600	-	-
1985	9,600	-	-
1986	9,600	-	-
1987	9,600	-	-
1988	9,600	-	-
1989	9,600	-	-
1990	9,600	-	-
1991	9,600	-	-
1992	9,600	-	-
1993	9,600	-	-
1994	9,600	-	-
1995	9,600	-	-
30-Year Requirements Thousands of Barrels	102,821	56,064	51,794

TABLE B-8

TOTAL ALBERTA AND PERMIT REQUIREMENTS 1966 - 1995

(Barrels Per Day)

Year	Canadian Hydrocarbons	British American	Board
1966	16,300	18,400	17,900
1967	18,000	18,100	18,900
1968	19,500	18,600	19,600
1969	21,100	21,000	20,000
1970	21,800	21,500	22,500
1971	22,400	22,000	23,500
1972	22,900	22,600	24,400
1973	23,400	23,100	25,200
1974	23,900	23,700	25,700
1975	24,400	24,300	25,900
1976	24,900	24,900	27,000
1977	25,400	25,400	27,700
1978	25,900	26,000	28,600
1979	26,500	26,500	29,500
1980	27,200	27,000	30,100
1981	27,800	27,600	22,200
1982	28,200	18,700	22,700
1983	28,900	19,300	23,100
1984	29,500	20,000	23,600
1985	30,200	20,700	24,000
1986	31,000	21,400	24,600
1987	31,600	22,200	24,900
1988	32,400	22,900	25,400
1989	33,200	23,800	25,800
1990	34,100	24,600	26,300
1991	35,200	25,500	26,600
1992	36,100	26,400	27,100
1993	37,100	27,400	27,500
1994	38,100	28,400	28,000
1995	39,000	29,400	28,400
30-Year Requirements Thousands of Barrels	305,140	256,011	272,546

APPENDIX C

THE MEETING OF THE PRESENT AND FUTURE REQUIREMENTS OF ALBERTA FOR PROPANE AND THE EXISTING PERMIT COMMITMENT, AND THE RESULTING SURPLUS

As discussed in Section VI of this report, the Board believes that there are three tests which must be satisfied in protecting for Alberta's requirements. The first test involves comparison of the total propane reserves (including those associated with two years growth of gas reserves) to the total thirty-year requirements. The second test involves a year by year supply-demand balance for the period of the requested permits. The final test is an alternative to a year by year supply-demand balance for the remainder of the thirty-year period and involves a comparison of the propane reserves remaining at the end of the term of the requested permit to the total requirements of the remainder of the thirty-year period.

Total Balance

The Board has compared the reserve and requirement estimates presented and described in detail in Appendices A and B. This calculation and the resulting surplus are shown in Table C-1. The table includes the surplus that would result using the reserve and requirement estimates submitted by each of the applicants. For purposes of comparison, the balance shown for each of the applicants uses only the propane reserves from two years growth of gas reserves even though British American suggested at the hearing that ten years growth of gas reserves should be considered. Also, the existing permit commitment as estimated by each of the applicants has been reduced to reflect expiry in 1981 of the per-

mit to remove propane from the Province.

The table shows that the propane reserves from existing plant facilities as estimated by the Board are 95 million barrels greater than the total thirty-year requirements. If the reserves from future plant facilities are included, this surplus increases to 159 million barrels. As discussed in Section VI, the Board considers that greater weight should be placed on the latter figure. The Board estimated surplus, including future plant facilities, of 159 million barrels, is lower than the more or less comparable figures of 184 million barrels estimated by Canadian Hydrocarbons or 252 million barrels estimated by British American. The Canadian Hydrocarbons estimated surplus is higher than the Board's because of a lower estimate by Canadian Hydrocarbons of Alberta's thirty-year requirements. The British American estimated surplus is much higher than the Board's because of both a lower estimate by British American of the thirty-year requirements and a higher estimate of the total recoverable propane reserves.

Balance on a Year by Year Basis

Prior to considering the problem of meeting requirements on an annual basis, it is in the Board's opinion, necessary to consider the ability of provincial propane production to meet seasonal peak demand for this product, the role of storage in meeting this demand, and the regional distribution of propane production and demand.

The Board in considering these matters has reviewed the detailed studies presented in Section VI of its June, 1961 report

to the Department of Mines and Minerals regarding several pipe line permit applications.(1)

With respect to the meeting of peak demands, a study of the seasonal demand pattern for propane indicates that the winter demand is considerably greater than the summer demand. This is because a major use of propane is for space heating. Gas production is greatest in winter, and since the production of propane is associated with gas production, it is also greater in winter than in summer. The study indicates that the load factor with respect to the production of propane is higher than the load factor with respect to the demand. As a result, if the average daily supply and demand for a particular year were in balance, the winter supply would be less than the winter demand and a deficiency would occur. It is expected that the annual production will be much greater than the annual demand and this will reduce or eliminate the possibility of winter shortages. In addition, extensive facilities for the short term storage of propane exist within the Province. These facilities include underground caverns, surface storage at processing plants and distribution centres and consumer storage, all of which will be available to help supply peak winter demand. Also, flexibility in future requirements for miscible flooding and the possibility of recovering propane on a seasonal basis from self-sustaining miscible flood schemes will help in meeting requirements during periods of peak demand. For these

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(1) Report to the Department of Mines and Minerals with respect to the applications under The Pipe Line Act, 1958, of several applicants. June, 1961.

reasons, the Board concludes that the meeting of Alberta's seasonal peak requirements for propane will present no serious problem in the foreseeable future.

With respect to the regional distribution of the supply and demand for propane, the Board has reviewed its 1961 studies and is convinced that a detailed area analysis is not warranted because propane is produced in various areas of the Province and marketing facilities exist over essentially the entire Province.

For these reasons, the Board believes it appropriate to carry out its analysis of the yearly supply-demand balance on an annual and a Province-wide basis.

Considerable evidence regarding the yearly pattern of the production of and the demand for propane in the Province was submitted to the Board at the hearings. This evidence has been discussed in detail in Appendices A and B of this report. The following is a discussion of the yearly surpluses of propane that would result if the forecasts of provincial production and requirements as submitted by each of the applicants were accepted, and also the surplus that results from the Board estimates. As in the case of the total reserves and requirements, adjustments have been made where necessary to place the forecasts submitted by each of the applicants and that prepared by the Board on a comparable basis.

Mr. McDaniel, on behalf of Canadian Hydrocarbons, submitted a yearly supply-demand balance for propane covering the period 1965 to 1996 inclusive. He included in the total demand the propane requested by Canadian Hydrocarbons in its application. The

supply, as projected by Mr. McDaniel and used in the balance, reflects only propane production from established reserves at rates consistent with 1964 recovery ratios. This results in a supply deficiency over essentially the entire period of the forecast. Mr. McDaniel then estimated that the projected deficiency would be eliminated by production from future gas discoveries and through the installation of deep-cut recovery facilities at existing plants. As a result, a complete balance occurs between propane supply and demand. Because of the manner in which the supply-demand balance was obtained by Mr. McDaniel, the Board has not presented his yearly surplus calculation in table form.

British American included in its submission a provincial supply-demand balance for propane for the period 1965 to 1976 inclusive. Details of the balance are presented as Table C-2. The table shows that British American forecasts a propane surplus of 5,900 barrels per day in 1965 increasing to some 20,000 barrels per day by 1968. The surplus is then expected to decline to 16,500 barrels per day by 1976.

Table C-3 presents a supply-demand balance for the period 1966 to 1986 based on the Board's estimates of supply and demand as presented in Appendices A and B. The table shows two cases: one reflecting production from existing propane recovery facilities and two years growth of gas reserves, and the other including future processing facilities. The production and requirements have been taken from Tables A-5 and B-8 respectively.

The table shows that for the case of propane production from existing facilities and two years growth of gas reserves, a sur-

plus of greater than 10,000 barrels per day exists for the period 1966 to 1969 inclusive. The surplus then declines to the extent that a small deficiency exists for the years 1984, 1985 and 1986. Including production from future processing facilities, the projected surplus is about 10,000 barrels per day for 1966 and 1967, increases to over 19,000 barrels per day in 1968 and then declines to some 4,000 barrels per day by 1986.

The Board's forecast surplus including future plant facilities is lower than that forecast by British American because of a higher production forecast by British American. As mentioned in Appendix A, the main reason for this is that the Board's estimated propane production from gas reserves not currently producing was based on an individual field assessment whereas the British American forecast applied the current propane recovery ratio to gas reserves not yet producing.

Balance for Remainder of Thirty-Year Period

Table C-4 has been prepared as a substitute for a year by year supply-demand balance for the remainder of the thirty-year period. It is a comparison of the remaining propane reserves as of the end of 1986 (the end of the permit term requested by Canadian Hydrocarbons) to the total requirements of the Province for the remainder of the thirty-year period, 1987 to 1995 inclusive. The table presents two cases: one reflecting production from existing processing facilities and two years growth of gas reserves, and the other including future facilities.

The table shows that the remaining reserves at the end of the

requested permit term will be 140 million barrels for the case of existing facilities or 151 million barrels including future facilities. It also shows that the total requirements for the remainder of the thirty-year period will be 88 million barrels. This results in a surplus of the then remaining reserves over the requirements for the remainder of the period of protection of 52 million barrels for the case of existing facilities or 63 million barrels including future facilities. Having in mind the considerations discussed in Section VI, the Board is satisfied that the requirements for the remainder of the thirty years can be satisfied with the reserves remaining at the end of the proposed period of removal.

TABLE C-1

COMPARISON OF PROPANE SURPLUS AS ESTIMATED BY THE BOARD
AND BY THE APPLICANTS (MILLIONS OF BARRELS)

	Board Study							
	From Existing Plant Facilities		Including Future Plant Facilities		Canadian Hydrocarbons[1]		British American[1]	
Propane Reserves								
Reserves from established gas reserves	325		389		390		449	
Reserves from two years growth of gas reserves	43		43		48[2]		55[2]	
Total Recoverable Propane Reserves		368		432		438		504
Propane Requirements								
Thirty-year Alberta requirements	221		221		202		200	
Existing permit commitment[3]	52		52		52		52	
Total Reserves Needed to Meet Alberta Requirements and Permit Commitment		273		273		254		252
Surplus		95		159		184		252

(1) Reserve estimates include future plant facilities.

(2) Propane reserves have been considered from only two years growth of gas reserves.

(3) Permit commitment has been considered identical for each analysis.

TABLE C-2

PROPANE SUPPLY-DEMAND BALANCE ESTIMATED BY BRITISH AMERICAN

(BARRELS PER DAY)

YEAR	PRODUCTION	ALBERTA REQUIREMENTS AND PRESENT PERMIT COMMITMENT	SURPLUS
1965	23,200	17,300	5,900
1966	29,800	19,400	10,400
1967	36,300	19,100	17,200
1968	39,500	19,600	19,900
1969	40,800	22,000	18,800
1970	40,500	22,500	18,000
1971	40,400	23,000	17,400
1972	40,600	23,600	17,000
1973	40,800	24,100	16,700
1974	41,300	24,700	16,600
1975	41,800	25,300	16,500
1976	42,400	25,900	16,500
TOTAL (MILLIONS OF BARRELS)	167	97	70

TABLE C-3

PROPANE SUPPLY-DEMAND BALANCE ESTIMATED BY THE BOARD

(BARRELS PER DAY)

Year	Production		Alberta Requirements and Present Permit Commitments	Surplus	
	From Existing Facilities and Two Years Growth of Gas Reserves	Including Future Processing Facilities and Two Years Growth of Gas Reserves		From Existing Facilities and Two Years Growth of Gas Reserves	Including Future Processing Facilities and Two Years Growth of Gas Reserves
1966	28,200	28,200	17,900	10,300	10,300
1967	31,400	31,400	18,900	12,500	12,500
1968	32,400	39,000	19,600	12,800	19,400
1969	32,200	39,000	20,000	12,200	19,000
1970	32,000	39,200	22,500	9,500	16,700
1971	31,800	39,300	23,500	8,300	15,800
1972	32,400	40,000	24,400	8,000	15,600
1973	32,300	40,000	25,200	7,100	14,800
1974	32,300	40,000	25,700	6,600	14,300
1975	32,300	40,400	25,900	6,400	14,500
1976	32,300	40,300	27,000	5,300	13,300
1977	32,100	40,100	27,700	4,400	12,400
1978	32,200	40,200	28,600	3,600	11,600
1979	32,100	40,200	29,500	2,600	10,700
1980	31,600	39,600	30,100	1,500	9,500
1981	29,900	37,900	22,200	7,700	15,700
1982	27,200	35,100	22,700	4,500	12,400
1983	25,400	33,300	23,100	2,300	10,200
1984	23,200	31,100	23,600	- 400	7,500
1985	22,100	29,900	24,000	1,900	5,900
1986	21,200	28,600	24,600	- 3,400	4,000
TOTAL (Millions of Barrels)	228	281	185	43	96

TABLE C-4

PROPANE SURPLUS REMAINING AT THE END
OF THE THIRTY-YEAR PERIOD
(MILLIONS OF BARRELS)

	From Existing Plant Facilities and Two Years Growth of Gas Reserves		Including Future Plant Facilities and Two Years Growth of Gas Reserves	
Total recoverable propane reserves	368		432	
Production during term of requested permits - to the end of 1986	228		281	
Propane reserves remaining at the end of 1986		140		151
Total requirements including existing permit commitment	273		273	
Requirements during term of requested permits - to the end of 1986	185		185	
Requirements for remainder of thirty-year period (1987-1995)		88		88
Surplus		52		63

APPENDIX D

THE APPLICANTS' REQUESTS FOR AUTHORIZATION FOR THE REMOVAL OF PROPANE AND THE SURPLUS WHICH WOULD RESULT IF THE REQUESTS WERE APPROVED

Canadian Hydrocarbons requested authorization to remove from the Province a total of 15,000,000 barrels of propane over a twenty-year period from October 31, 1966. The average quantities to be removed under the requested permit declines from 3,350 barrels per day initially to 1,720 barrels per day during the final ten years. The propane is to come from the Harmattan area plant. As is discussed in detail in Section VI of this report, because Canadian Hydrocarbons did not offer contracts covering a sufficient proportion of the volumes requested, the Board is not prepared to consider a permit for the request in full. However, the Board is prepared to consider the Canadian Hydrocarbons application on the basis of the lower volumes set out in Section VI.

British American requested authorization to remove from the Province a total of 7,300,000 barrels of propane over a ten-year period beginning November 15, 1965. The propane would be removed at an average rate of 2,000 barrels per day over the period of the requested permit and would come from the Rimbey, Nevis and Pincher Creek plants. The Board is satisfied that British American's share of the propane from these plants will be in excess of 2,000 barrels per day for the period of the requested permit, and accordingly is prepared to consider the impact of the permit as requested by British American on the provincial surplus of propane.

Total Balance

Table C-1 has shown that the total available propane reserves

are some 159 million barrels greater than the thirty-year requirements of the Province and the existing permit commitment. If the total of the adjusted Canadian Hydrocarbons request and the British American request is provided for (11.9 million barrels plus 7.3 million barrels equals 19.2 million barrels), a surplus of some 140 million barrels still remains. If only the reserves associated with existing plant facilities are considered, this results in a reduction in the total surplus to some 76 million barrels.

Balance on a Year by Year Basis

Table D-1 has been prepared to determine if the requested quantities are surplus on a year by year basis to Alberta's requirements. The table presents two cases: one reflecting propane production from established reserves and existing recovery facilities plus two years growth of gas reserves, and the other including production from future processing facilities. The table covers the years 1966 to 1986 inclusive, which are set out in column 1. Column 2 has been taken from Table C-3 of this report, and is the propane surplus to Alberta's requirements and the existing permit commitment as projected by the Board for the two previously mentioned cases. Columns 3 and 4 show the adjusted volumes proposed for Canadian Hydrocarbons and the volumes requested by British American, respectively. Column 5 is the resulting surplus for each case.

The table shows that for the case of existing facilities plus two years growth of gas reserves, the proposed permit quantities can be satisfied and a surplus of some 8,000 barrels

per day will exist in the early years of the period under study. The surplus will gradually decline to a balanced situation by 1983, and a deficit is predicted for the years 1984, 1985 and 1986. If production from future facilities is included, a surplus results throughout the period of the study. The surplus will increase from some 8,000 barrels per day in 1966 to about 15,000 barrels per day in 1968, and thereafter will decline to some 2,500 barrels per day by 1986.

Balance for Remainder of Thirty-year Period

Table D-2 is a comparison of the remaining propane reserves as of the end of 1986 (the end of the permit term requested by Canadian Hydrocarbons) with the total requirements of the Province for the remainder of the thirty-year period, 1987 to 1995 inclusive. The table presents two cases: one reflecting production from existing processing facilities and two years growth of gas reserves, and the other including future facilities.

The table shows that the remaining reserves at the end of the requested permit term will be 140 million barrels for the case of existing facilities or 151 million barrels including future facilities. It also shows that the total requirements for the remainder of the thirty-year period will be 88 million barrels. This results in a surplus of the then remaining reserves over the requirements for the remainder of the period of protection of 52 million barrels for the case of existing facilities or 63 million barrels including future facilities. Having in mind the considerations discussed in Section VI of this report, the

Board is satisifed that the requirements for the remainder of the thirty years can be satisfied with the reserves remaining at the end of the proposed period of removal.

PROPANE SURPLUS IF CURRENT APPLICATIONS WERE GRANTED

(BARRELS PER DAY)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Surplus Prior to Considering Applications (1)				Remaining Surplus	
Year	From Existing Plant Facilities and Two Years Growth of Gas Reserves	Including Future Processing Facilities and Two Years Growth of Gas Reserves	Canadian Hydrocarbons Reduced Volumes (2)	British American Request	From Existing Plant Facilities and Two Years Growth of Gas Reserves	Including Future Processing Facilities and Two Years Growth of Gas Reserves
1966	10,300	10,300		2,000	8,300	8,300
1967	12,500	12,500	2,130	2,000	8,400	8,400
1968	12,800	19,400	2,040	2,000	8,800	15,400
1969	12,200	19,000	2,040	2,000	8,200	15,000
1970	9,500	16,700	1,910	2,000	5,600	12,800
1971	8,300	15,800	1,770	2,000	4,500	12,000
1972	8,000	15,600	1,750	2,000	4,300	11,900
1973	7,100	14,800	1,610	2,000	3,500	11,200
1974	6,600	14,300	1,480	2,000	3,100	10,800
1975	6,400	14,500	1,480	1,750	3,200	11,300
1976	5,300	13,300	1,480		3,800	11,800
1977	4,400	12,400	1,480		2,900	10,900
1978	3,600	11,600	1,480		2,100	10,100
1979	2,600	10,700	1,480		1,100	9,200
1980	1,500	9,500	1,480		1,000	8,000
1981	7,700	15,700	1,480		6,200	14,200
1982	4,500	12,400	1,480		3,000	10,900
1983	2,300	10,200	1,480		800	8,700
1984	400	7,500	1,480		- 1,900	6,000
1985	1,900	5,900	1,480		- 3,400	4,400
1986	3,400	4,000	1,480		- 4,900	2,500

(1) From Table C-3.
(2) Adjusted on basis of propane contracts offered by Canadian Hydrocarbons.

TABLE D-2

PROPANE SURPLUS REMAINING AT THE END
OF THE THIRTY-YEAR PERIOD
(MILLIONS OF BARRELS)

	From Existing Plant Facilities and Two Years Growth of Gas Reserves		Including Future Plant Facilities and Two Years Growth of Gas Reserves	
Total recoverable propane reserves	368		432	
Production during term of requested permits - to the end of 1986	228		281	
Propane reserves remaining at the end of 1986		140		151
Total requirements including existing permit commitment	273		273	
Requirements during term of requested permits - to the end of 1986	185		185	
Requirements for remainder of Thirty-year period (1987-1995)		88		88
Surplus		52		63

APPENDIX E

IN THE MATTER of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956; and

IN THE MATTER of a Permit to Canadian Hydrocarbons Limited.

PERMIT NO. CH 65-1

WHEREAS Canadian Hydrocarbons Limited (hereinafter called "the Permittee") has applied to the Oil and Gas Conservation Board for a permit pursuant to The Gas Resources Preservation Act, 1956, for the removal from the Province of propane produced at the Harmattan area gas processing plant; and

WHEREAS the Board, upon inquiry into and hearing of the application has found that the Permittee is a person who has entered into contracts to purchase propane within the Province and who proposes to remove propane, or cause it to be removed, from the Province, and that the provisions of the said Act affecting the application have been complied with; and

WHEREAS the Board is of the opinion that the granting of this Permit for the removal of propane from the Province is in the public interest having regard to the present and future needs of persons within the Province, and to the established reserves and trends in growth and discovery of the reserves of gas or propane in the Province; and

WHEREAS the Lieutenant Governor in Council has given his approval by Order in Council numbered , and dated .

THEREFORE, the Oil and Gas Conservation Board, pursuant to the provisions of The Gas Resources Preservation Act, 1956, hereby grants a Permit to Canadian Hydrocarbons Limited, and hereby authorizes the removal of propane from the Province, subject to the regulations and orders made pursuant to the provisions of the said Act and to the terms and conditions prescribed in this Permit, as follows:

1. Subject to the conformity by the Permittee with the terms and conditions hereof, this Permit shall be operative for a term commencing on November 1, 1966, and ending on October 31, 1986.

2. (1) The quantity of propane that may be removed from the Province pursuant to this Permit shall not exceed in any of the following twelve-month periods the maximum quantity prescribed for that period as follows:

Twelve-Month Period	Maximum Quantity
November 1, 1966 to October 31, 1967	776,000 barrels
November 1, 1967 to October 31, 1968	746,000 barrels
November 1, 1968 to October 31, 1969	407,000 barrels
November 1, 1969 to October 31, 1970	365,000 barrels
November 1, 1970 to October 31, 1971	343,000 barrels
November 1, 1971 to October 31, 1972	338,000 barrels
November 1, 1972 to October 31, 1973	314,000 barrels
November 1, 1973 to October 31, 1974 and subsequent years	293,000 barrels

(2) Notwithstanding subclause (1), the Board, upon application made by the Permittee on or before August 1, 1968, and upon being satisfied that it has entered into additional contracts

to purchase propane at the Harmattan area gas plant, may stipulate greater maximum quantities for any of the third or subsequent twelve-month periods in place of those prescribed in subclause (1), but such greater maximum quantities shall not exceed those prescribed in subclause (1) by more than 110 per cent of the quantities provided for in the additional contracts and in no case shall be greater than the maximum quantities prescribed as follows:

Twelve Month Period	Maximum Greater Quantity
November 1, 1968 to October 31, 1969	746,000 barrels
November 1, 1969 to October 31, 1970	697,000 barrels
November 1, 1970 to October 31, 1971	646,000 barrels
November 1, 1971 to October 31, 1972	639,000 barrels
November 1, 1972 to October 31, 1973	588,000 barrels
November 1, 1973 to October 31, 1974 and subsequent years	540,000 barrels

3. The Permittee, for the purpose of this Permit, may purchase or otherwise acquire for removal from the Province, and there may be removed from the Province under the authority of this Permit, only propane obtained from the processing, in the Harmattan area gas processing plant located in Sections 27 and 34, Township 31, Range 4, West of the 5th Meridian, of gas produced from the Harmattan-Elkton Field and the Harmattan East Field.

4. The Permittee shall satisfy the Board prior to February 28, 1966, that arrangements have been completed for financing the construction of any required transportation facilities and that construction will commence not later than April 29, 1966, unless, upon application by the Permittee, later dates are stipulated by the Board.

5. The effective commencement of removal of propane from the Province pursuant to this Permit shall be on or before December 30, 1966, unless, upon application by the Permittee, a later date is stipulated by the Board.

6. (1) All propane removed from the Province pursuant to this Permit shall be measured by or on behalf of the Permittee in a manner and at a point to be approved by the Board.

(2) The measurements required by this clause shall be reported monthly to the Board in a manner approved by the Board.

7. The Permittee shall supply propane at a reasonable price to any community or consumer within the Province that is willing to take delivery of propane at a point on the pipe line of Hydrocarbons Pipelines Ltd. or at the Harmattan area gas processing plant, and that, in the opinion of the Board, can reasonably be supplied by the Permittee.

8. If any community or consumer is willing to take delivery of propane pursuant to clause 7 of these terms and conditions, and agreement on the price to be paid for the propane cannot be reached, the price to be paid shall be determined by the Public Utilities Board on the application of an interested party.

9. Notwithstanding the provisions hereof, the Permittee shall comply with the provisions of any Act, competent regulation, order or direction governing the production, conservation, transportation, processing, purchasing, acquisition, sale, measurement, reporting, testing, supply or delivery of propane

within the Province.

MADE at the City of Calgary, in the Province of Alberta, this day of , A. D. 1965

OIL AND GAS CONSERVATION BOARD,

G. W. Govier

Chairman.

APPENDIX F

IN THE MATTER of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956; and

IN THE MATTER of a Permit to The British American Oil Company Limited.

PERMIT NO. BA 65-1

WHEREAS The British American Oil Company Limited (hereinafter called "the Permittee") has applied to the Oil and Gas Conservation Board for a permit pursuant to The Gas Resources Preservation Act, 1956, for the removal from the Province of propane produced at the Rimbey, Nevis and Pincher Creek gas processing plants; and

WHEREAS the Board, upon inquiry into and hearing of the application, has found that the Permittee is a person who produces and has the right to produce propane within the Province, and who proposes to remove propane, or cause it to be removed, from the Province, and that the provisions of the said Act affecting the application have been complied with; and

WHEREAS the Board is of the opinion that the granting of this Permit for the removal of propane from the Province is in the public interest having regard to the present and future needs of persons within the Province, and to the established reserves and trends in growth and discovery of reserves of gas or propane in the Province; and

WHEREAS the Lieutenant Governor in Council has given his approval by Order in Council numbered and dated .

THEREFORE, the Oil and Gas Conservation Board, pursuant to the provisions of The Gas Resources Preservation Act, 1956, being chapter 19 of the Statutes of Alberta, 1956, hereby grants a Permit to The British American Oil Company Limited and hereby authorizes the removal of propane from the Province subject to the regulations and orders made pursuant to the provisions of the said Act and to the terms and conditions prescribed in this Permit, as follows:

1. Subject to the conformity by the Permittee with the terms and conditions hereof, this Permit shall be operative for a term commencing on November 1, 1965, and ending October 31, 1975.

2. The quantity of propane that may be removed from the Province pursuant to this Permit shall not be more than 730,000 barrels in any year, commencing November 1, during the term of the Permit.

3. The Permittee, for the purpose of this Permit, may remove from the Province under the authority of this Permit only propane obtained from the processing, in gas processing plants located in Section 33, Township 38, Range 22, West of the 4th Meridian, in Section 23, Township 4, Range 29, West of the 4th Meridian, and in Section 5, Township 44, Range 1, West of the 5th Meridian, of gas from the Nevis Field, the Fenn-Big Valley Field, the Stettler Field, the Hackett Field, the Pincher Creek Field, the Homeglen-Rimbey Field, and the Westerose South Field.

4. The effective commencement of the removal of propane from the Province pursuant to this Permit shall be on or before January 1, 1966, unless upon application by the Permittee a later

date is stipulated by the Board.

5. (1) All propane removed from the Province pursuant to this Permit shall be measured by or on behalf of the Permittee in a manner and at a point or points to be approved by the Board.

(2) The measurements required by this clause shall be reported monthly to the Board in a manner approved by the Board.

6. (1) The Permittee shall supply propane at a reasonable price to any community or consumer within the Province that is willing to take delivery of propane at the Rimbey, Nevis or Pincher Creek gas processing plants, and that, in the opinion of the Board, can reasonably be supplied by the Permittee.

(2) In the event that propane is removed from the Province pursuant to this Permit by pipe line, the Permittee shall supply propane at a reasonable price to any community or consumer within the Province that is willing to take delivery of propane at a point on the pipe line transmitting the propane within the Province, and that, in the opinion of the Board, can reasonably be supplied by the Permittee.

7. If any community or consumer is willing to take delivery of propane pursuant to clause 6 of these terms and conditions, and agreement on the price to be paid for the propane cannot be reached, the price to be paid shall be determined by the Public Utilities Board on the application of an interested party.

8. Notwithstanding the provisions hereof, the Permittee shall comply with the provisions of any Act, competent regulation, order or direction governing the production, conservation, trans-

portation, processing, purchasing, acquisition, sale, measurement, reporting, testing, supply or delivery of propane within the Province.

MADE at the City of Calgary, in the Province of Alberta, this day of A. D. 1965.

OIL AND GAS CONSERVATION BOARD

G. W. Govier

Chairman